Annual report on the Management of Govt. Farm Estate, Madras, 1870-71 to 1880-81

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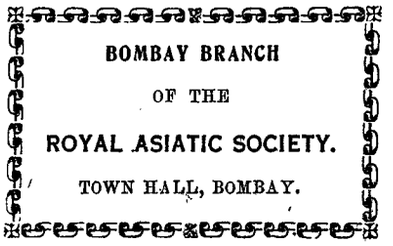

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ANNUAL REPORT

ON THE

MANAGEMENT OF THE GOVERNMENT FARM ESTATE,

FOR THE YEAR ENDING 31ST MARCH 1871.

ROYAL ... OF THE BOMBAY BRANCH OF ...

1. THIS Estate consists of the properties formerly known as Roshanbaugh Estate and Homes' Garden, and is situated near the Sydapet Village. A portion of the Estate situated on the north side of the Cutcherry compound, which is quite isolated from the remainder of the property, has been let to a tenant for a term of five years, at an annual rent of Rupees 160, under stringent conditions as to cultivation, &c. About 130 acres on the south side of the ravine constitutes the "Experimental Farm," and about 120 acres on the north side is occupied by the "Model Farm." The remainder of the Estate is occupied by the Roshanbaugh College, the Wudder Village, the Sydapet School and the Commissariat slaughter-[illegible] and grounds.

[illegible] would in preparing these Reports for the Reporter to confine himself [illegible] more to a narration of the different works done, and the general results obtained during the year under review. I intend, in the present instance, to depart a little from the usual course. Our experience has now, I think, arrived at a stage which will justify us in forming some [illegible] on the general results of our labours. We require something more than a mere [illegible] doings; our work is becoming educational. We need to place on record [illegible] details than has hitherto been thought necessary. I believe that, to a very [illegible] extent, the small progress made in this country towards the establishment of a [illegible] system of agriculture is chiefly to be attributed to the almost entire absence [illegible] showing what has been done by those who have made agricultural reform their [illegible]. We, of the present day, are doubtless unearthing facts which were discovered [illegible] and possibly going over ground which was long ago proved to be barren in beneficial results.

Season.

3. The year commenced very unfavourably. There was no rain during either April or May; the heat during these months was intense, and stock suffered greatly; the land was parched and so hard the plough could scarcely penetrate it; indeed, it was quite as hard as it usually is in cold countries after a severe frost. The weather was much more favourable in June; the heavy showers on the 11th and 12th enabled us to commence ploughing again. We took advantage of this opportunity to sow a few acres of cumboo and gingelly. The showers in July and August were very favourable for growing crops, but caused a great deal of extra work on the fallows in keeping down weeds; indeed, the land was cleaned with great difficulty the; more it was cultivated and worked, the faster the weeds grew. The rain-fall of these two months was 16 inches, nearly 7·08 inches more than the average for the same period during the last ten years. A considerable area of crop was put down early in September; the dry weather experienced during the latter half of the month was very severe on the young seedlings. October was an excessively wet month; the total rain-fall, 16·63 inches, was 8·19 inches above the average of this month during the last ten years. On the 18th and 19th upwards of 10 inches fell. Much injury was done to the crops which had been sown during the previous month. Dry crops would have been much better with one-fourth of the fall; however, wet crops luxuriated in the deluge, and tanks filled rapidly.

The weather during the early part of November was favourable for getting in the regula cold weather crops. All dry crops suffered in December, the total rain-fall of these tw months being only 6·64 inches, 8·20 inches below the average fall for the same period during the last ten years. Crops sown in November after the heavy rains of October started well and grew vigorously for the first four or five weeks, when the dry weather began to be felt Their after-growth was slow; the plants were dwarfed; and the grain, in most instances, wa very imperfect. A comparison between the rain-fall of these two months—the most import ant months in the year to the dry land cultivator of this district—and of the correspondin months of last year gives the following results:—

	1869.		1870.	
	Rain-fall.	Wet days.	Rain-fall.	Wet days.
November...	8·35	20	5·44	12
December...	5·24	9	1·20	3
Total ...	13·59	29	6·64	15

4. The weather experienced during the remainder of the year needs no special comment. Though the rain-fall of the year is the heaviest we have had during the last ten years, I have no hesitation in recording my opinion that the past season has been a very indifferent one for the dry land cultivator, though a very good one for the cultivator of wet lands.

The monthly registrations are as follows:—

	Inches.		Inches.
April	...	November	5·44
May	...	December	1·20
June	8·32	January	1·20
July	8·48	February	·08
August	7·52	March	·70
September	6·90		
October	16·63	Total Inches ...	57·07

5. The daily registrations are recorded in the Appendix.

Buildings and Permanent Improvements.

6. The granary referred to in my last Annual Report has been completed. It is a good and spacious building, and has been very useful during the past twelve months. The abundant space at command enables us to make purchases of cake or other cattle food whenever market rates are sufficiently low. The upper floor affords ample accommodation for seeds sent for storage. The packing room is a great convenience; in it all seeds are cleaned and packed for distribution.

7. The results attending the loose box system introduced last year having been so very satisfactory, it was determined to convert all the cattle byres into loose boxes; this has been done with the best results. Under the old system the cattle were fastened by a chain to the front of the stall. They had very little space, and could not lounge comfortably. The byre has been divided by palmyrah poles fixed in brick and chunam pillars into spaces each containing about seventy square feet. It now affords space for four or five additional cattle, and every animal has plenty of room. The flooring of the old byre was removed and the ground was sunk about a couple of feet. Into these boxes the cattle are turned loose at the middle and end of the day. A sufficiency of bedding is always allowed, and the manure accumulates until it rises to the level of the surrounding ground; thus we save the expense of daily removal, and preserve the fertilizing qualities of the manure.

8. The Fences have been cut over and brought into a better shape, and a considerable quantity of fresh seed put down in blanks and other deficient parts of the hedges. These Corkapilly hedges are difficult to raise on our sandy soils, but when once the roots get down into the sub-soil out of the reach of the sun's rays they are constantly green, and are not only useful but ornamental fences. Fifty grafted mango trees, fifty cocoanut trees, and about fifty tamarind and other trees were planted last season on the Experimental Farm. A nursery has been started; in it it is intended to raise young trees for planting over the Estate. The fifty acres of land which we resumed possession of last year, has all been cleared and brought under cultivation, and a considerable area of the low land near the river side has been laid out for irrigation; a portion of this is watered by gravitation, and of the remainder none is more than two feet above water level. Though in the wet season this land will constantly be subjected to flooding, still, during at least nine months in the year there is no danger of this. This wet land will afford an abundance of green food in the dry season, when the high land is parched and bare. A considerable amount of work was done last year in levelling the surfaces of the different fields, and in cutting open-drains to carry off the water which falls during heavy rains.

9. The portion of the Estate situated on the northern side of the ravine was cleared, fenced, and brought under cultivation during the past year, and about 120 acres was laid out and set apart for the purposes of a Model Farm. This land was formerly in the hands of tenants. It returned during the last four years an average annual revenue amounting to 535 rupees. It was necessary, in order that the land should be thoroughly reclaimed and put into a good cultivatable condition, that a large number of indifferent mango and guava trees should be cut down. These were chiefly old trees which would not continue to bear much longer, though for a season or two they would be worth 150 rupees per annum. Deducting this sum from the average annual income from the land, there remains a balance of 385 rupees, and this sum will be the yearly rent to be recovered from the Model Farm. The timber and jungle clearings realized 2,721 rupees, this was carried to the credit of the Estate, and again laid out on permanent improvements on the land, the Model Farm having to pay seven-and-a-half per cent. per annum on the outlay. The gross annual income from this land under the new arrangement will, therefore, be nearly eight per cent. above the average collection of the past four years.

10. These Permanent Improvements, or Landlord's Improvements as they are elsewhere [illegible] as follows:—A complete set of Farm buildings, consisting of Overseer's residence; three large sheds for cattle, containing thirty-one loose boxes; a cart and implement shed; a straw house; a grain and tool store; two poultry houses; pig styes, &c., the total cost of which was Rupees 1,757-7-8. Fencing the land cost Rupees 142-11-3. Clearing and levelling cost Rupees 1,204-15-5. The roads cost Rupees 408-1-10, and certain small items, not included in the foregoing, made the total expenditure Rupees 3,522-11-2. A sheep shed is being erected, and a well to supply the buildings with water is still needed; but, with these items added, I do not think that the actual outlay on permanent improvements on the Model Farm will reach 3,800 rupees.

11. A building containing blacksmith and carpenter's workshops has been erected, in which all kinds of agricultural implements and tools can be made or repaired.

12. A Village School for the children of the work people was commenced during the year. It owes its origin and support, during the first few months of its existence, to the liberality of a Member of Committee. It is now supported from Farm Funds. It is popular amongst the villagers, and is fairly attended by the children, while many of the men have expressed a wish to be allowed to avail themselves of the School Teacher's services. He is, however, scarcely a suitable man. There are 150 families resident in the village, and, with a properly qualified teacher,—that is, one who understands the people—much good might be done amongst them.

13. This Farm is situated on the south side of the ravine. It is bounded on the west by the Mount Road, and on the south and east by the river Adyar. It contains about 130 acres. The soil is, as I have often had occasion to remark, one of the poorest under cultivation. With the exception of four or five acres near the river, the Farm is entirely under dry cultivation. About a dozen acres can be watered by the wells; but the average lift is nearly twenty feet. This Farm is devoted exclusively to experimental cultivation, and is purely Educational.

Cattle.

Nellore Bull	1
Buffalo Bulls	2
Working Cattle	27
Feeding Cattle	21
	51

14. The large increase in the area of this farm has necessitated the employment of four or five additional pairs of draught cattle. They were all fully employed throughout the year. In the dry season, when very little farm work could be done, they were employed on Estate Improvements. Their food consisted of maize and cholum straw, either green or dry according to the season, with horse gram and ground-nut cake.

15. To ascertain the relative feeding-values of ground-nut cake and horse gram as foods for working cattle, the following experiment was made:—A lot of eight draught cattle of average size and similarly worked was equally divided. One lot was fed daily on 12 lbs. of ground-nut cake, and the other lot on 12 lbs. of horse gram; the following are the results:—

On Ground-nut Cake.

	lbs.
First weighing	2,737
Last weighing twenty-seven days afterwards	2,733

On Horse Gram.

First weighing	3,097
Last weighing twenty-seven days afterwards	3,070

16. The ground-nut cake was steeped before being given to the animals, and the gram was boiled in the usual manner. Besides these foods the cattle had a full allowance of straw.

17. The cost of the cake used was about 90 lbs. per rupee, and of the gram 80 lbs. per rupee.

18. The experiment proves that working cattle will keep in better condition when fed on cake *alone*, than they will when fed exclusively on gram.

19. Ground-nut cake can generally be purchased here at a lower price than gram; and the manure made by the consumption of a ton of cake is much more valuable than that made from the consumption of a ton of gram.

20. I have long thought that to boil gram for our live stock is a useless piece of extravagance. The careful feeder who is acquainted with the extraordinary manner in which gram will increase in volume when abundantly supplied with moisture, and therefore knows the danger of administering it to animals in its natural state, endeavours by boiling to expand the gram to its fullest limits before it enters the stomach of his stock. His primary object is thus to effect a mechanical and not a chemical alteration in the food. True, there will be some slight chemical changes in effecting this, still they are only trifling, and can give it no additional value. Finding by careful experiment that a volume of gram increased in nearly the same ratio, whether boiled or steeped, I tried the effects of steeped gram on a riding horse which was much out of condition. I gave him daily 4 lbs. of gram (a little over

Madras Measure) and 2 lbs. of ground-nut cake. Both the gram and cake were thoroughly soaked in cold water. The monthly cost of feeding was as follows:—

	Rs.	A.	P.
Grass-cutter's pay	3	0	0
60 lbs. of ground-nut cake, at 90 lbs. per rupee ...	0	10	8
120 lbs. of horse gram, at 80 lbs. per rupee	1	8	0
Total ...	5	2	8

21. This allowance is too small for a horse that has to run in harness fifteen or eighteen miles a day; still for a large number of the horses of this district, which are only used for two or three hours in the morning under the saddle, it is enough.

22. The horse has now been fed in this manner for three months, and has made most satisfactory progress. Though this horse never refused the steeped gram but ate it as well as he would eat boiled gram, still I should mention that another horse not only refused the steeped gram, but preferred to starve rather than eat it. It is, however, well to remember that the horse-keeper in the substitution of steeping for boiling will experience a diminution in his perquisites, and therefore will do little to facilitate the change.

23. I had no means of testing the matter further on horses; but the experiment is so interesting, and promises such beneficial results, that I have no doubt but that those who have greater opportunities will bring the matter to an issue.

24. In cattle feeding the results of my experiments with steeped gram have been most successful. For some time the cattle on these Farms were all fed on steeped gram. Amongst many others the following experiments were made to test the relative feeding-values of boiled and steeped gram. A lot of sixteen draught cattle, similarly worked, was equally divided. One lot was fed daily on 12 lbs. of *boiled* gram and 12 lbs. of ground-nut cake, while the other lot received daily 12 lbs. of steeped gram and 12 lbs. of ground-nut cake.

25. The animals on the boiled gram— lbs.

Weighed at the commencement of the experiment ...	6,339
Twenty-seven days afterwards they weighed	6,576
Showing an increase of	237

The animals on the steeped gram—

Weighed at the commencement of the experiment ...	6,310
Twenty-seven days afterwards they weighed	6,576
Showing an increase of	266

26. I am so satisfied with the general results of these experiments that I will, in future, abandon altogether the boiling system, and adopt the cold water method.

27. It is difficult to state the *exact number* of hours that it is necessary to steep gram before it is fit for consumption; so much depends upon the temperature of the air: if the weather is very hot, a shorter time is necessary than during cold weather. But each experimenter can decide this for himself; it is only necessary, at a known time, to put, say, an ounce of raw gram into a tumbler of cold water, and to note at what time it ceases to expand. Under ordinary circumstances fifteen hours is sufficient.

28. The following may be interesting:—Fifty lbs. (16½ Madras Measures) of mixed gram, old and new, was put into 90 lbs. (25 Measures) of cold water. It was steeped for seventeen hours. After being allowed to drip the gram was found to weigh 95½ lbs., while it measured 38 Madras Measures; 46½ lbs. of water remained in the vat, so that had we used only half the quantity of water, or 45 lbs., it would have been enough. The residue water contained 1 lb. 9¼ oz. of extractive matter, chiefly gum and mucilage, which the water had extracted from the Gram.

29. The results of the foregoing experiment may be summed up as follows:—One measure of gram steeped in one measure of water will, after soaking for fifteen hours, yield a volume equal to nearly 2½ measures. A little less if the gram is old, and a little more if it is new.

30. Fifty lbs. (16½ Measures) of the same gram was then put into a boiler along with 90 lbs. (25 Measures) of water. After boiling for three and a half hours it was removed, and after being allowed to drip, was measured, when it yielded 38½ Madras Measures, only half measure more than was obtained by the cold water process. The total weight was 100½ lbs. Seventeen and a half lbs. (4½ Measures) of water remained in the boiler, this contained 2 lbs. 5 oz. of colouring and extractive matters, chiefly gum and mucilage. The firewood consumed weighed 32 lbs.

31. All the working and feeding cattle are now stabled in loose boxes. The change has been most beneficial. The animals have enjoyed perfect health, and the feet of the working cattle are as sound as they were under the old system; indeed, I think they are better now than formerly; the horn of the hoof is less flinty, and more elastic.

32. A number of cattle have been fattened, with results very similar to those detailed in the last Report.

Sheep.

Rams	10
Ewes	85
Wethers	22
Gimmers	15
Lambs	54
	186

33. We have still a number of indifferent sheep in our flock. These we are weeding out as they become ready for the butcher. The flock is, however, greatly improved; the sheep are becoming more uniform in shape and in size. I hope ultimately, by continuing on in the present course, to produce a flock possessing all the good qualities of the best of our sheep. Our success has been, so far, most satisfactory. The lambs of this season are the best and the most uniform lot we have had since I knew the flock.

34. I adopted the plan proposed in the last Report, and put the ram to the ewes a month later than last year. The result has been all that I could wish; instead of eight or ten per cent. of our lambs dying, we have not lost two per cent.

35. This season both ewes and lambs were kept in the sheds until the lambs were five or six weeks old. I found, in former seasons, that the very young lambs suffered greatly from the heat of the sun.

36. By carefully selecting the rams, and by breeding only from ewes that possess certain qualities we are gradually producing a new variety of sheep.

37. The rams we are now distributing are valued greatly by Native Flockmasters. In confirmation of this I may record, amongst other instances, that we recently had an application from the Coimbatore District—where we had just sent five rams—for a dozen of our best rams, for which certain Native Flockmasters would willingly pay the full price and the carriage to Coimbatore. We have also had applications from Ceylon and from different parts of India. Though this is not a sheep district I have had several applications for rams for use in this locality. I have had most reluctantly to refuse several of these applications as our flock is so small, and as it must be some time yet before our improved breed will be regularly established. It is certainly very desirable to issue rams of the improved breed as early as possible, but I think that it is still more desirable to stamp the flock with some fixed characteristic before sending out any number of sheep. It must be remembered that this variety is only the result of careful selection, and that it will deteriorate, almost as rapidly as it has been improved, if left to injudicious management. This is now only the third season since this system of selection was commenced.

38. As the breed is quite a distinct variety, being entirely the result of artificial circumstances, it should have a name. I propose, therefore, in all future communications or Reports, to refer to this breed as the "Sydapet Sheep."

39. Amongst other characteristics of this breed, it comes earlier to maturity; it gives a larger per-centage of flesh for the food it consumes; and has a much better constitution than

any Native breed I am acquainted with. They have a fair covering of wool; but it is, as must be expected in these scorching plains, not of first rate quality. When introduced to colder districts I have no doubt but that they will be good wool-producers.

40. A full sized ram averages about 115 pounds "live weight." The following are the weights of three of our "Sydapet Rams":—

123 Pounds.
103 do.
101 do.

The last of these rams is under two years old.

41. The ewes are smaller; when full grown and in fair condition they will average from seventy-five to eighty lbs. per head.

42. We are now grazing our ewes and lambs over the second-crop cholum and on the horse gram. They are getting on very satisfactorily. I have not yet been able to provide myself with sheep nets; but hope before another season to be fully supplied with these, when we will adopt a regular light-land system of management, and grow gram, cholum and cumboo for consumption on the land, in preparation for maize, cotton and other valuable crops which the scarcity of manure prevents us from growing to any extent at present.

Pigs.

Boars	2
Sows	8
Young Pigs	19
	29

43. Pigs are useful as a part of the live stock of a Farm; but they are not a very remunerative stock, excepting under special circumstances. The past has been a fair average year, yet our sales during the twelve months only realized Rupees 271-6-8, while the cost of feeding and attendance amounted to Rupees 185, leaving a balance of Rupees 86-6-8. To this must be added the value of the manure, probably another 15 rupees, making a gross return of Rupees 101-6-8. But, as the present value of the stock is only Rupees 230, while it was valued at Rupees 307 at the commencement of the year, the profit is only Rupees 34-6-8; about six per cent. on capital invested on buildings and stock.

Poultry.

44. The Brahma Dorking Breed of fowls, introduced from Australia two years ago, still maintain their valuable qualities. They are now largely distributed over the Presidency, and generally with the best results.

Manure.

45. The cattle boxes have yielded a considerable quantity of excellent manure. This manure is a great deal more valuable than any thing of the sort I have yet met with in this country. It contains all the liquid and solid excrements of the animals.

46. We have altogether abolished the cattle byres and the open manure yard.

47. The time required by the boxes in becoming full varies according to the season. During the wet season, when we use more bedding, and give our stock more green food, they fill more rapidly than during the dry season when the evaporation is great and green food scarce. Probably on the average twelve weeks would suffice. When full each box contains a volume of manure equal to about five cart-loads; the weight varies with the season.

48. Our fifty loose boxes on this farm will during an average year yield us 1,000 cart-loads at least of really good manure. Under no other system do I believe it possible to obtain a result any thing like this.

49. Besides fold-yard manure we have used a considerable quantity of tank mud, brickyard dust, the refuse of the Commissariat slaughter-houses, bazaar ashes, &c. The

last-mentioned manure when it consists, as it does sometimes, entirely of the ashes of cow-dung is very valuable. We have also used a considerable quantity of carbonate and sulphate of lime with fair success. The carbonate of lime used was the ordinary shell chunam of the district. It cost about 15 rupees per ton, a price much too high for ordinary agricultural use, but, as will be seen on a reference to the Sorghum Experiment, the expenditure incurred for lime was repaid with a large balance over.

50. Inquiries have been instituted for lime suitable for Farm use. Samples have been received from Cuddapah, Poontoor, and from the village of Vellicherry near Guindy Park. Dr. King, the Chemical Examiner, kindly made the following analyses of these lime-stones :—

Vellicherry Lime-stone.

	Per Cent.
Carbonate of lime	70·0
Moisture	1·2
Clay, sand, and other materials insoluble in Hydrochloric acid	28·8
	100·0

Poontoor Lime-stone.

Carbonate of lime	75·4
Moisture	2·0
Clay, sand, and other materials insoluble in Hydrochloric acid	22·6
	100·0

Cuddapah Lime-stone.

Carbonate of lime	76·90
Moisture	2·85
Clay, sand, and other materials insoluble in Hydrochloric acid	20·25
	100·00

51. The first lime-stone can be delivered at the Farm at about 2 rupees per ton; but it is in the raw state, and needs to be calcined before it is applied to the soil: this is the difficulty. Coals at 30 rupees per ton are far too expensive, and the native plan of burning it with wood and cow-dung fuel is very little cheaper. In fact, lime-dealers ask as much for calcined lime-stone as they demand for calcined shells. It is perfectly true that lime may be applied to the soil in a powdered state without being calcined with the probability of some little good being done, but the action of unburnt lime is so very unimportant that it will in very few instances repay the cost of its application. Until coal becomes cheaper there is little probability of much lime being used in Indian agriculture, and, seeing that lime used on an impoverished soil without any other manure only hastens the final exhaustion, it is perhaps as well.

52. Sulphate of lime, the refuse of the Soda Water Manufactory, has also been used with considerable success. This can be delivered at the Farm at about 1 rupee per load.

53. Natural sulphate of lime has also been tried, but it has to be brought a considerable distance, and costs nearly 20 rupees a ton at the Farm.

54. I have this year used saltpetre (nitrate of potash) with *great* success. It will be noticed that in the experiment, with Sorghum Saccharatum, an expenditure of 18 rupees per acre on saltpetre doubled the crop and left, after paying expenses, a profit amounting to nearly 30 rupees per acre.

55. The saltpetre used in this instance was bought in Madras at the rate of 10 lbs. per rupee. However it is not necessary to purchase the finest sorts; suitable samples for top-dressing can be purchased at a much lower price. The late Collector of Salem kindly

forwarded me a sample of crude saltpetre from his district, which could be procured there at 60 rupees a ton; the following is the analysis of this sample:—

	Per Cent.
Moisture	7·90
Sand	4·30
Chlorides	5·40
Pure Nitre (nitrate of potash)	82·40
	100·00

This is a very economical manure in districts where it can be had at any thing like this price. The heavy expense of conveying to Madras, which includes a most unreasonable railway charge of Rupees 65 per ton, makes it rather a costly article for the ryots of this district; still, as I have already proved, it will pay to use it in top-dressings in quantities of 100 or 120 lbs. per acre on certain crops.

Irrigation.

56. As I have elsewhere stated, we have only four or five acres of land on this Farm that can be watered by gravitation. The great bulk of our land is situated at a level at least twenty feet above the water mark.

57. Though several of our water lifts do their work in a very satisfactory manner, we have none that can water an acre of land at the high level at a less cost than 1 rupee.

58. Under ordinary circumstances a watering is equal to a rain-fall of two inches, or about 45,000 gallons. A crop of five months paddy grown during the cold season in this district would, allowing for the usual rain-fall, require at least thirty waterings to bring it to maturity; a little less or a little more as the soil is porous or retentive.

59. The cost of watering would, therefore, amount to 30 rupees per acre; to this must be added the cost of cultivation, seed, manure, rent &c., probably together amounting to 15 rupees. A crop of paddy will, therefore, cost 45 rupees. A fair crop in this district will yield 600 measures of grain and one ton of straw per acre. At present rates the grain would be worth 20 rupees, and the straw 10 rupees. Under these circumstances a crop of paddy could only be produced at a loss of 15 rupees per acre.

60. While, therefore, we cannot on these *high levels* grow paddy *at a profit*, it does not follow that it is a mistake to attempt to raise water to such a height for agricultural purposes. There are crops that will pay for an *occasional* watering, and there are times when the stock owner is glad to give any price for green food. Under such circumstances it is good policy to raise water even as high as twenty feet. Still I believe that, as a rule, it will be found much the safest and most profitable plan on these high levels to sow only such crops as seasonable weather will suffice to bring to maturity, and to avoid, as much as possible, raising water to any height exceeding ten feet.

61. We have abandoned the "Steam Water Lift;" it was far too costly; with this exception all the water lifts described in the last Report are in regular use whenever their services are really required.

62. I have long thought it a great mistake to raise water to a height of fifteen or twenty feet and then to pass it two or three hundred yards along earthen channels on embankments; there is such an enormous waste of water from soakage, a matter of *considerable* moment, when it is remembered that the water required for irrigating an acre of paddy costs, each time, one anna at the least for every foot it is raised above water level. I think, when it is necessary to send water to any reasonable distance, it is a better plan to make a channel instead of raising an embankment, and to allow the water to flow by gravitation to the place required. The loss from soakage would thus make no difference to the cultivator, and the water could be raised *just where* it is required.

63. When the level is not more than ten or twelve feet above the water mark, and other circumstances permit, a system of main channels with picottahs, at the points where the water is needed, would, I think, be a much better arrangement than our present plan.

64. We have a surface of fifteen or twenty acres suitable for channel irrigation; the land has been surveyed, and will during the present year be laid out for irrigation in the manner described.

Rotations of Crops.

65. Undoubtedly many benefits result from the adoption of a rotation in cropping; still these advantages may be purchased at *too high* a cost. In a well cultivated district which is not subjected to any great atmospheric changes, but where the seasons recur with clock-work regularity, and with perfect uniformity, it may be desirable to introduce a regular system of rotation. A properly arranged rotation of crops not only enables the farmer to make the best use of the plant food in his soil, but tends to conserve these fertilizing ingredients. One tribe of plants thrive and luxuriate upon food which may not only be useless, but even noxious to another tribe. One order of plants delights in lime, another in phosphoric acid, a third in potash, and so on. Some plants have tap roots, some fibrous roots. The roots of some plants feed on the surface of the land, while the roots of others derive their sustenance from the lower stratum. Some plants are consumed by stock on the Farm, and the excrements of the animals fed on them are again returned to the soil; while others are removed from the Farm, and none of the fertilizing matters they contain are returned to the soil. Some plants have narrow leaves and have an upright habit of growth and encourage the growth of weeds; while others have broad leaves and put out lateral branches which shade the ground and check the growth of weeds. If a certain crop is cultivated year after year on the same piece of ground, it will ultimately remove such a quantity of the particular plant food it delights in as to render the raising of a remunerative crop of this particular plant a matter of great difficulty. Granting that by careful manuring the elements of plant food taken up by a certain crop can be regularly returned to the soil, there are still many difficulties to contend against. Thus, it has been found that certain insects prey on particular crops, and that if these crops are repeated too frequently, they increase to such an extent as to interfere very seriously with the profitable culture of these particular crops. Again some plants—many of the leguminous for example—have large fleshy roots, in which they have stored up a large amount of nitrogenous matter, which they have elaborated from the ammoniacal matter their leaves have taken from the air, these roots, when left in the soil, decay, and afford a large quantity of excellent food for the following crop. This is well known in England where a good Clover crop—and therefore plenty of fleshy roots—is invariably followed by a good crop of wheat, and I have noticed here that a cereal crop after a gram crop is generally a good one. Though a large crop of gram removes a good deal of lime from the soil, it is nevertheless considered by ryots as a restorative crop, and the reason I have just given explains this apparent paradox. This Farm being devoted exclusively to experimental cultivation, I have adopted no rotation of crops; it is useless to attempt to fix a rotation, until we have discovered all the qualities and peculiarities of the different crops we are called upon to grow. We might afterwards devote a portion of the Farm to experimental rotations, but at present we have not the space to lay aside for the purpose. On the "Model Farm," however, as we get the land under regular cultivation, I intend to adopt a rotation in cropping; still this cannot be done for some time. The uncertainty of our spring cropping in this locality owing to the irregularity of the rain-fall during the prevalence of the south-west monsoon will always be a hindrance to the establishment of a fixed rotation, as the possibility or otherwise of growing a spring crop will always effect the rotation. A failure in the crop of turnips or clover always upsets a rotation in England; but the case must be much worse *here* where the weather may be such as altogether to prevent the sowing of one of the crops in the rotation. As far as my experience in this country enables me to judge, I would suggest the following dry land rotation as one worth trying on the better kinds of sandy loams in districts circumstanced like this:—

Autumn Crop.—Maize: well manured; followed by *horse gram*, consumed on the land by sheep.

Spring Crop.—Gingelly.

Autumn Crop.—Cotton: manured with well rotted fold-yard manure, with about 1 cwt. per acre of bone dust.

Spring Crop.—Cumboo: as a fodder crop; consumed while green on the land by sheep and cattle.

Autumn Crop.—Yellow Cholum: well manured with fold-yard manure; first crop seeded, second crop eaten on the land by cattle and sheep.

Spring Crop.—Cumboo.

Autumn Crop.—Green Gram: well manured; followed by *Tenney.*

Spring Crop.—Indigo: ploughed in.

Autumn Crop.—Maize: as before.

66. This is a four years' rotation, but, instead of only including four crops as it would in England, it includes ten crops. Of course many modifications of this rotation could be adopted; indeed it is impossible to suggest a rotation that will suit all. In this rotation we have seven crops the produce of which can be sold; the other three are restorative crops, being consumed on the land. This rotation provides for an abundant supply of fodder at all seasons of the year — also for the frequent change of crops — and it is arranged for the manure to be applied to the autumn crop during the heavier monsoon, as when applied to the spring crop, with a light rain-fall, it either forces the plant too much at first, rendering it unable to withstand the effects of a drought, or, if the weather be *very dry,* it remains undecomposed in the land, making the soil light and puffy, and adding greatly to the injurious effects of the drought. A "Hundred Acre Farm," under this rotation, will annually have twenty-five acres under cotton, a much larger area than I think it would be safe to grow under any present arrangement; while during the year a surface equal to 150 acres will be available for growing crops for human consumption.

Chinese Sugar-cane.

67. This is the true "Sorghum Saccharatum;" it is a millet, and in habit of growth and in general appearance resembles the cholum of this country.

68. The seed was obtained from Sydney.

69. The soil having been cultivated as for cholum was sown on the 10th of October 1870. The total area of the piece of land selected was 3,484 yards, and the seed used weighed ten pounds.

70. The seed was sown in drills about two feet apart. It germinated very slowly, and took at the least double the time required by cholum in coming through the ground. However the crop was regular, and the plants healthy.

71. When about four inches in height a portion of ground was divided into plots, each containing $\frac{1}{18}$ of an acre, and different manural top-dressings were applied.

72. The Peruvian Guano used was an inferior sample; it contained a very small percentage of ammoniacal salts. The other manures were such as are procurable in this district, and the prices charged are the prices actually paid. The carbonate of lime was powdered shell chunam. All the applications were reduced to a powder before being used; they were all mixed with sand, in order that they should be equally distributed over the ground. A quiet morning was selected for sowing the manure; a drill cultivator followed immediately behind the sower, and covered the manure. The crop was grown entirely under dry cultivation; it grew well, and had at all times a promising appearance.

73. The drill cultivator was passed two are three times through the crop during its early growth, and this was all the cultivation it received.

74. In their early growth the canes contained very little more sugar than ordinary cholum. The quantity of saccharine matter was greatest at the time when the seed began to harden. It is at this stage that it is usual in America to cut down the crop for the pur-

pose of extracting the sugar. Harvesting commenced on the 25th of January; the following are the results:—

Actual Results.

No. of Plots.	Area of Plots.	Manure used.	Value of Manure.	Yield of Grain.		Yield of Straw.
				Weight.	Measure.	
	Square Yards.		RS. A. P.	lbs.	M. Mrs.	lbs.
1	268	13 lbs. of guano	1 0 0	89¼	42	1,045
2	268	152 „ of carbonate of lime	1 0 0	106¼	50	1,302
3	268	10 „ of saltpetre	1 0 0	123	58	1,440
4	268	Nothing	1 0 0	54¼	26	849
5	268	37 lbs. of bone dust	1 0 0	106	50	1,285
6	268	112 „ of sulphate of lime	1 0 0	102	48	1,280
7	268	13 „ of guano	1 0 0	91	42	1,083
8	268	159 „ of carbonate of lime	1 0 0	93½	44	1,125
9	268	10 „ of saltpetre	1 0 0	97¼	46	1,196
10	268	Nothing	1 0 0	65¾	31	968
11	268	37 lbs. of bone dust	1 0 0	110½	52	1,372
12	268	112 „ of sulphate of lime	1 0 0	91¼	43	1,082½

Average Results.

Manure.	Yield.		Increase due to Manure.	
	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.
Unmanured	60	908	...	...
13 lbs. of guano	90	1,064	30	156
152 „ of carbonate of lime	99	1,237	39	329
10 „ of saltpetre	110	1,318	51	410
37 „ of bone dust	108	1,328	48	420
112 „ of sulphate of lime	96	1,181	36	173

Financial Results per Acre.

18 Rupees per acre expended on—	Increase due to Manure.		Value of Increase per Acre.	Profit.
	Grain.	Straw.		
	lbs.	lbs.	RS. A. P.	RS. A. P.
Guano	540	2,808	24 4 3	6 4 3
Carbonate of lime	702	5,922	36 9 10	18 9 10
Saltpetre	900	7,380	46 7 6	28 7 6
Bone dust	864	7,560	45 8 3	27 8 3
Sulphate of lime	648	4,914	32 9 1	04 9 1

75. In the above calculations the straw was valued at 5 rupees per ton, a low price; and the grain at the rate of thirty pounds per rupee, also a very low price; we bought the seed in Sydney last season at the rate of four pounds per rupee, the usual price in Australia for this seed, and our sample is much superior.

76. It is gratifying to find that saltpetre (nitrate of potash), an indigenous product, has given the best results. An expenditure of 18 rupees per acre on this manure having not only nearly doubled the crop, but, after repaying its own cost, left an additional farmer's profit of nearly 30 rupees per acre. The value of saltpetre has long been recognized in England; but its great cost in that country has prevented its general use. Nitrogen is

always more acceptable to plants in the form of nitrate than in ammonia. Nitrate of soda is very largely used in England, and so also would nitrate of potash (saltpetre) be much used if it could be obtained at the price at which most farmers in this country can procure it. This salt is best applied as a top-dressing when the crop is a few inches above the ground: 100 pounds or at most 150 pounds per acre is enough to apply: it should always be mixed with an equal volume of sand or some similar material, in order that it may be more regularly distributed over the ground. Bone dust stands second in my list; probably, if the continued effects of each be considered, it should stand first. Next comes carbonate of lime (chunam) An expenditure of 18 rupees on lime was not only repaid by the increase in the crop, but a profit of nearly 20 rupees was added. Sulphate of lime (gypsum) comes next; this also not only repaid its original cost, but left an additional profit of nearly 15 rupees per acre. The guano repaid its cost, but only left a profit of about 6 rupees per acre. As I have already stated, the guano was inferior; still I think there are other reasons for the small return it gave. I use the words "small" return merely in connexion with the foregoing results. A surplus of 6 rupees per acre over the cost of any manure is far from being an unsatisfactory profit. Until I have made further experiments I would not like to speak with any degree of certainty; still I am much inclined to believe that the nitrogen, presented as it would be in the form of ammonia, was of very little value to the plant, and that whatever efficacy the guano possessed must be attributed to its phosphates and potash. It must not be taken for granted that, because saltpetre and the salts of lime produced such good results on our soils, they will necessarily produce as good results on other soils; for if a soil is rich in lime or potash it will not benefit it greatly to apply either; though there are few soils under cultivation that will not repay the cost of either, still those results indicate the kind of food most acceptable to the cholum tribe. Each farmer should experiment, and thus ascertain for himself the wants of his soil.

77. The fodder is very valuable; all kinds of stock are extremely fond of it; it is quite unnecessary to chaff the straw; both the cattle and sheep eat every particle placed before them. It is rather difficult to keep it from the attack of ants, its extreme sweetness rendering it very attractive to them.

78. After removing the crop I had the stubble watered and manured, and there is now a fair second crop. But to secure the largest quantity of fodder the crop should be cut at an earlier stage than in the instances under review. We cannot hope to obtain both the maximum quantity of fodder and the maximum quantity of grain. If we obtain a large yield of the one, we must be content with a lesser yield of the other.

Chumba Paddy.

79. Two plots, each containing one-fifth of an acre, were prepared in the usual manner for paddy. One was manured with twelve loads of yercum plants (Calatropis gigantea), the manure was worked into the puddle, and after fermentation had taken place the land was ploughed up twice or thrice until all the bad smelling gases had been driven off. It was then, on October 5th, sown broad-cast with four measures of chumba paddy. The crop grew satisfactorily, and was reaped on the 2nd of January, when it yielded 182 measures, or 409 pounds of grain, equal to 910 measures, or 41 bushels per acre.

80. The other plot was similarly prepared. It was manured with ten loads of fold-yard manure. This manure was worked into the puddle in the same manner as the yercum leaves in the foregoing experiment. Four measures of seed was sown broad-cast over the land on the 5th October. The crop was harvested on the 2nd of February, and yielded 160 measures or 375 pounds of grain, equal to 800 measures, or 36 bushels per acre.

Green Gram ("Phaseolus Mungo").

81. A piece of land measuring about half an acre was sown with twelve pounds of green gram on the 26th of October. The seed was sown in lines about twenty-two inches apart. The drill cultivator was passed along between the drills two or three times during the early growth of the crop; this not only kept down the weeds, but prevented the soil from

cracking and becoming "hide-bound." The crop grew vigorously, and produced at least twice as much leaf as is usually produced by the horse gram. I did not ascertain the feeding value of its fodder, being anxious to test its grain-producing qualities; but I propose next season to grow it as a fodder crop, and to determine its value in feeding stock. That stock will eat it freely I have already ascertained. The crop was harvested on the 26th of February, and yielded 10 marcals, or 240 pounds of seed. This, at the present market price eight measures per rupee, would give 10 rupees (or 20 rupees per acre) as the value of the grain.

82. As during the ripening process the greater portion of its leaves fall upon the ground it must add considerably to the fertility of the soil, seeing that its leaves, like the leaves of all leguminous plants, absorb from the atmosphere a large quantity of ammoniacal gases. The straw, when the plant is allowed to mature its seed, is not of much value.

83. Green gram will make a useful plant in a rotation. Not only is it a remunerative crop to grow, but it restores ammoniacal matter to the soil, and allows of the ground being tilled and cleaned during its growth.

Gingelly ("Sesamum Indicum").

84. Four measures of gingelly seed were sown on the 20th of June on a well prepared piece of land measuring 7,700 square yards.

85. The seed was sown in drills about twenty inches apart.

86. The crop grew very satisfactorily, and would have returned a very large yield of seed had it not been for the very heavy rains that fell while the plant was in full flower.

87. Harvesting was commenced on the 11th of September. The out-turn of grain amounted to 912 pounds.

88. Another plot measuring 4,356 square yards was sown with two-and-a-half measures on the 16th of June. The crop was harvested on the 23rd of September, and yielded 762 pounds of grain.

Castor Oil Plant.

89. A piece of land, measuring two-fifths of an acre, was ploughed and manured with a small quantity of fold-yard manure in July last. It was sown in the same month with one-and-a-half measure of castor oil seed. The seed was sown in drills about twenty-four inches apart.

90. The plants now (March 31) are still bearing. The total yield of clean seed, up to this date, is 124 measures, worth, at present market price, Rupees 11-10-0.

Horse Gram ("Dolichos Uniflorus").

91. A considerable area of land was sown with horse gram as a "Catch Crop," and chiefly for the production of fodder. The crop has proved a valuable one for this purpose. Most of our cold weather crops mature in four months, thus affording ample opportunity for growing a crop or two of gram fodder during the cultivating season. If there are showers in August we can safely take a crop of gram fodder off the land before it is time for sowing our regular cold weather crops. The crops—maize, cholum, &c.,—sown in October will be harvested during the early part of February, thus affording plenty of time for another gram crop before the hot weather sets in. Our practice is, immediately after the removal of the crop, to plough up the stubble, collect weeds, &c., and sow the gram as close behind the plough as possible, and to harrow and roll immediately afterwards; the great object being to keep the moisture in the land. At this late season rain seldom falls, and if the land is allowed to lose its moisture, either by the ploughing being delayed too long after the removal of the previous crop, or by delaying the sowing and after-operations when the land is ploughed, it will be useless to expect a crop. I have known gram remain for months in the ground without germinating, simply from carelessness in allowing the moisture of the soil to escape. If, in an ordinary season, the crop gets above the ground before the end of February, even though there be no rain during the next six weeks, the dews will suffice to bring it forward.

92. We had, on March 31st, a considerable area of crop sown after the removal of the regular crop, which promised to yield a very fair return of fodder—no unimportant matter at that season of the year, when scarcely a green blade of grass can be found on the pastures. I have found this late crop of gram fodder invaluable for the ewes and lambs. They are very fond of it, and its succulent and nutritive character greatly adds to the quantity and quality of the ewes' milk.

Hurriallee Grass.

93. The old "Hurriallee Meadow," which measures three acres, gave five cuttings during the past year, yielding eight tons thirteen cwts. of hay. Excepting about fifty square yards, watered for experimental purposes, the meadow was solely watered by the rain-fall. As it is proposed to do away with this meadow, and to plant the grass on a lower level, I applied no manure whatever. Ten rupees would repay every other expense incurred on behalf of this meadow.

94. The hay was sold for Rupees 360-13-3, and the cost of cutting, making, &c., was Rupees 105, leaving a profit of Rupees 85-4-1 per acre. To this may fairly be added 5 rupees per acre for grazing during the dry season.

95. I am glad to have to record that the grass is gradually becoming less aquatic in its character, and that I have hopes of establishing it ere long as a "dry" crop, independent of artificial irrigation.

96. The grass will be carefully removed to a more suitable situation during next wet season, and will be planted with the plough in the same manner that beans are planted in some parts of Scotland. I put down two acres in this manner a few months ago: we have had very little rain since the grass was planted, so the crop has not made much progress; I am, however, quite satisfied with its present appearance, and feel sure that, after it has enjoyed a monsoon, it will be regularly established. The cost of planting was very trifling, not more than one-tenth of the usual cost. The land having been well cleaned, received a dressing of about five tons per acre of fold-yard manure: when ploughing in the manure a woman followed each plough and dropped the grass roots in the open furrow, these the succeeding plough covered up, when its furrow was similarly planted, and the process repeated; a heavy harrowing and rolling completed the work.

97. Being anxious to see what amount of work our coolies really could do with our improved grass knives in cutting hurriallee grass, I offered three small prizes for "quick and good work." The ground selected was laid out in the usual sized beds, and the crop was very similar. Fifteen coolies entered for competition; each plot contained 120 square yards; the following are the results:—

	Time occupied. Minutes.		Time occupied. Minutes.
1st Man	115	9th Man	134
2nd do.	117	10th do.	135
3rd do.	118	11th do.	139
4th do.	119	12th do.	141
5th do.	122	13th do.	153
6th do.	123	14th do.	155
7th do.	123½	15th do.	158
8th do.	130		

98. The work was fairly done; however the labourers worked at a much greater speed than they could continue at during a whole day. The result shows what they can do under extraordinary circumstances. The average time required to complete the work was 132 minutes, at this rate eleven men should cut an acre per day. My experience is that it usually takes nearly twice this number. Formerly, when the common country knives were used, it was considered that forty men did a fair day's work if they cut one acre per day. The competition took place in the early morning while the men were fresh, and before the heat of the sun became unpleasant; so the results obtained cannot be taken as *average* results. Probably fifty per cent. added would more nearly represent a fair day's work.

Though it is certainly a great step in advance to cut an acre of grass on land divided under these troublesome beds by sixteen men in one day at a cost of 3 rupees, I cannot look upon the result, as any thing like what we ought to attain. In England three and six pence to four shillings per acre is a fair price to pay for cutting meadow hay; this is equivalent to the pay of two average field labourers, and here we are content if we get the same work done by sixteen field labourers. The fault is not so much with the men as with the system; as long as hurriallee grass is grown in these wretched little beds, we cannot hope to reduce greatly the cost of cutting. If we can succeed in growing as good crops on a surface where the scythe can be used, I have no doubt but that the cost of cutting could be reduced to twelve annas, or at the most one rupee per acre.

99. Hurriallee, like most other meadow grasses, should be cut immediately the flower begins to appear; at this state the juices of the grass are more nutritious, and the hay is far superior than when made from the fully matured plant. Besides, when cut before the seed appears, the plant is more vigorous and produces another crop much sooner. Hurriallee hay is generally spoiled in this country by being too much exposed to the sun's rays. It is quite unnecessary to bleach the grass, in order to make it into hay. The great object should be to retain the green colour of the grass by drying it as quickly as possible. Under ordinary circumstances, two days, or at the most three days, should suffice for making the hay.

100. Cutting should not commence until the dew is off the grass. The grass should remain on the ground for an hour or so after being cut. It should then be turned and tossed until sun-set. It cannot be tossed too much during a hot sun. To preserve the green colour and aroma of the hay it is absolutely necessary to keep it moving. At night, if the dews are heavy, it should be put up in small cocks, each containing from two to three cwts. These cocks should not be tramped, though it is advisable to beat smooth the outside with the back of a rake, in order, that should a shower of rain fall, the water may run off without penetrating the mass. A single hay rope should be passed over the cock, to prevent it from being blown to pieces by a gust of wind. Next morning, after the dew is off the ground, the cocks may be opened again, and the hay spread out. It must be tossed and turned again, as on the previous day; care being taken that it is constantly kept moving. At the end of the second day, under usual circumstances, it will be fit to cart; though if the weather be at all damp or foggy it will be advisable to give it another day's sunning, of course putting it again into cock at night.

101. Hay thus rapidly made is rich in saccharine matters, and is, therefore, very liable to heat and ferment: this, to a moderate extent, does no harm; in fact it gives the hay a good flavour; however care must be exercised that it does not go too far and char the hay. If the hay is loose in a room, exposure for an hour or two in the hot sun will put it all right, or a layer or two of dry paddy or cholum straw may be put through the mass. In the stack it is equally easy to prevent too great fermentation. I have found a single line of six-inch drain pipes placed at about the middle of the stack from the centre to the outside, a capital arrangement for keeping down the temperature. A thick bamboo, or a couple of hollow pieces of the stems of palmyrah or cocoanut trees, the one resting on the other so as to form a pipe, will equally effect the purpose, or, in building, two or three layers of dry paddy or cholum straw placed in the stack will prevent it heating to an injurious extent.

Prairie Grass ("Bromus unioloides").

102. A small supply of American Prairie grass was obtained from Australia last season. A piece of good soil was suitably prepared for it, and the seed was sown in drills nine inches apart. Only a very small proportion of the seed germinated.

103. Though it is now nearly six months since the grass was sown, it is only about four or five inches in height. Care will be taken of the plants, and results carefully noted.

Perennial Rye Grass ("Lolium perenne").

104. A plot of ground was sown with perennial Rye grass obtained from Sydney. The seed was a good sample; it was sown on the 29th of October. The crop was some time in

coming through the ground, and never grew satisfactorily. The ground was fairly covered, but the grass had always a sickly, unhealthy appearance. A few hot days scorched it so much I saw that it was useless to continue the experiments longer, so had the crop ploughed in.

Flax.

105. A few pounds of Egyptian Flax was sown on the 26th November. It grew very satisfactorily. It was cultivated as a dry crop, and matured its seed. The straw was not more than two-and-a-half feet in length; but the weather was unusually dry during its growth. I intend to try this crop on a larger scale next season.

Carolina Paddy.

106. This crop being no longer an experimental one, and the soils on this Farm being very unfavourably situated for irrigation, I sent greater part of the imported seed to the Model Farm for trial.

107. We cannot afford to experiment on the "Model Farm," and the crop was, therefore cultivated as an ordinary Farm crop; in fact in the same manner as country paddy.

108. All the crops were transplanted from seed beds.

109. The first crop was sown in the nursery beds on the 8th of August, and was transplanted on the 6th of September. The ground occupied by the plants measured 1,800 square yards. The soil was not in good condition; the field had been recently levelled, the high parts had been reduced, and the hollows had been filled. The plants grew well where the ground had been raised, but very indifferently in the places where the top soil had been removed. Harvesting commenced on the 12th of December. The yield of grain was 157 Madras Measures, equal to 950 pounds, or 20 bushels per acre.

110. Another plot, measuring 2,027 square yards, was planted on the 7th and 8th of September with seedlings aged thirty days. The crop was harvested during the last week in December, and yielded 424 measures, or 960 pounds of grain, equal to 1,012 measures, or 46 bushels per acre.

111. A third plot, containing 2,650 square yards of land, was planted on the 16th of September with seedlings about twenty-four days old. The crop was harvested on the 24th of January, and yielded 488 measures, or 1,120 pounds of grain, equal to 891 measures, or 40 bushels per acre.

112 The grain was very good; indeed both the first and the second prizes for Carolina paddy at the Agri-Horticultural Society's Show, held in February last, were awarded to it.

113. A small experiment was made on this Farm with seedlings aged forty days. I was anxious to ascertain whether, if planted out as old as this, fair results could be obtained; as when planted out at forty days old, instead of twenty-one days, we would save nearly three weeks' watering during the after-growth of the crop.

114. The plot measured one-fifth of an acre; it was well manured with fold-yard manure puddled in in the usual manner. The seedlings were reduced to half their height, and planted in the puddle on the 22nd of September.

115. The crop was cut on the 3rd of December, and yielded 215 pounds of grain, equal to 1,075 pounds, or 23 bushels per acre. The yield of grain is small; still, as the crop was watered only for about three months, instead of nearly four months, circumstances may arise which may make this practice worth adopting. The occasional watering of the few square yards (the seedlings for an acre occupy) in the nursery will not together amount to more than a single watering of the transplanted crop.

Buckwheat.

116. A bushel of this seed was obtained from Sydney, and a portion of it was sown on the 8th of October on a piece of suitable soil in fair condition.

117. The crop grew and flowered; it never exceeded the height of six inches, and, as it promised to yield a poor return of seed, it was ploughed down.

Artichokes.

118. A plot of land, measuring about one-fifth of an acre, was ploughed and manured with four cart-loads of fold-yard manure, and, on the 23rd of August, was planted with thirty-five pounds of Artichokes. The sets were planted about a foot apart in drills. The crop was harvested on the 8th of February, and yielded 331 pounds of tubers.

Red Cholum.

119. A supply of red cholum was obtained from Salem. The grain is similar in size to yellow cholum, but is quite red.

120. On the 12th of October we sowed twenty-eight pounds in the same manner as we sow yellow cholum. It was reaped on the 14th of February, and yielded 270 pounds of very good seed. The return of straw was large; the crop was very tall and closely packed upon the ground. The result was satisfactory. The soil was good, and probably yellow cholum would have given a better return; still it is well not to be altogether dependent on one variety of cholum.

Imphee.

121. This is "the Caffrarium" of the Australians. It is a variety of Sorghum, and is very similar to the Sorghum Vulgare, or white cholum of this district. Imphee is supposed to have been originally obtained from the south-eastern coast of Africa. In America it is by many considered a better sugar-producer than the Chinese sugar-cane, and all agree that its sugar is much more easy to crystallize. I obtained a few pounds of seed from Sydney, and sowed it on the 30th of November, but its growth was very unsatisfactory: it has not produced more than one-tenth of the crop the Chinese sugar-cane produced, while it requires a much longer time in coming to maturity. It is only now beginning to ripen. The canes are thick, but very short, and so far I cannot detect the presence of any more saccharine matter than is present in our common cholums. I intend to repeat the experiment again next season.

Egyptian Maize.

122. A supply of maize was obtained from Egypt. The sample was much inferior to the varieties we have introduced from Australia; indeed it was no better than the indigenous maize of India.

Maize.

123. A further supply of maize was obtained from Sydney; but the quality was not so good as that obtained last season.

124. The varieties obtained were the Richmond River, the Mackey, and the Hogan.

125. The following table shows the per-centage of vital seeds each sample contained:—

	Per Cent.
Richmond River	85
Mackey	83
Hogan	77

126. A sample of Queensland—one hundred and twenty day variety—which was saved from last year's crop for seed contained 98 per cent. of vital grain. The cobs since harvest have been suspended over ropes in the granary. The seed was in a very fine state of preservation; it had received little or no damage from insects. Another sample of this maize, which had been shelled shortly after harvest, and had been stored in the usual manner, was so much injured by weevils as to be almost worthless as seed.

127. With the exception of the few acres sown in alternate rows with cotton, the crop was cultivated precisely in the same manner as last season.

128. As in last report I gave very minute details regarding our cultivation of this crop and the results attending its cultivation, it seems unnecessary to go over the same ground again.

129. Twenty-five pounds of the Richmond River variety was sown on the 5th October. The crop was reaped on the 29th of December, when it yielded 1,112 pounds of cobs and 2,225 pounds of straw. The weather being so excessively dry during the four weeks previous to harvest the plants ripened prematurely, and the yield was thereby lessened greatly. The cobs are small, and the straw short; this variety is evidently one of the dwarf varieties of maize.

130. Twenty pounds of Hogan maize was sown on the 13th of October, and was reaped on the 21st of January. The yield was only 507 pounds of cobs. This is a small-sized variety, and, as it does not possess any merit that the Queensland and Mackey do not also possess, does not appear to deserve much attention.

131. Twenty-five pounds of Mackey maize was sown on the 17th of September. It was harvested on the 27th of January, and yielded 2,702 pounds of cobs. This is a large variety of maize. The cobs are larger than those of any variety we have yet introduced. The grain is also large, but is flat and square-shaped. The straw was bulky, and the crop stood nine or ten feet high. This is a good variety, and is well worth general cultivation.

132. Several experiments were made with different manural top-dressings on the maize crop, amongst others the following:—When the maize was six or eight inches above the ground, ten plots of equal size were manured with different manures, at a cost in each instance of 18 rupees per acre. The results are as follows:—

Manure.		Yield per Acre.			
		Gross Yield.		Increase due to Manure.	
		Cobs. lbs.	Straw. lbs.	Cobs. lbs.	Straw. lbs.
Average of duplicate experiment.	Unmanured	1,350	2,430	...	...
	Carbonate of lime	1,746	3,150	396	720
	Sulphate of lime	1,566	2,970	216	540
	Saltpetre	1,746	3,636	396	1,206
Single experiment.	Guano	1,710	3,564	360	1,134
	Bone dust	1,764	3,294	414	864

133. In none of these instances was the cost of the manure repaid; this is entirely to be attributed to the dry weather experienced. During the seven weeks previous to harvest we only had two showers of rain, while the total fall only amounted to one inch.

134. I have found that top-dressings, unless the weather is showery, produce little or no effect on our short-lived crops. Though we hoed in the top-dressing with the drill cultivator, still the upper two or three inches of soil was so extremely dry that the manural applications remained almost in their original condition. Had the crop been a slow-grower, even without a greater rain-fall better results would have been obtained. In this instance the maize was on the ground only for six weeks after the manure was applied.

135. I gather from this experiment that for crops which only remain three or four months on the ground it will be the safest to apply the top-dressing before sowing the seed, instead of after the crop appears above ground. It is not desirable to bring the seed and these manures into contact. But this is easily managed; a single stroke of the harrow, after-broad casting the manure, and before the grain is sown, will suffice to prevent any damage being done to the seed.

Cumboo ("Peniallaria Spicata").

136. About two-and-a-half acres of land were sown with cumboo during the second week in June. Before sowing, the soil had been ploughed, harrowed, and weeded in the usual manner, and about five tons of fold-yard manure had been spread broad-cast over its

surface and ploughed in. Nine Madras Measures or about twenty-five pounds of seed was used. It was sown about one inch deep, and in lines twenty-two inches apart.

137. The crop was cultivated two or three times by the drill cultivator. It grew vigorously, and reached an average height of from eight to nine feet.

138. At this stage in its growth I cut down an average portion of the crop on about 350 square yards, and found the yield to be 1,268 pounds of green fodder, equivalent to 18,000 pounds per acre. This green fodder was given to the cattle: they ate it freely, and throve very satisfactorily upon it. An idea is prevalent amongst ryots that cattle will not eat cumboo straw. They certainly do not care for the dry cumboo straw which has matured its grain; but they are quite as fond of it in the green state as they are of green cholum and other green fodders. The following experiment was made with green cholum and green cumboo straw:—

—	Bullock fed on Green Cumboo Fodder.	Bullock fed on Green Cholum Fodder.
	lbs.	lbs.
July 18th ...	302	214
July 28th ...	310	217
Increase ...	8	3

139. This experiment was conducted over much too short a period to produce results of any practical value. It however proves that not only will cattle eat green cumboo fodder, but that they will thrive upon it.

140. The remainder of the crop was allowed to seed; it was harvested on the 6th of September, and yielded 1,672 pounds of grain, about 668 pounds per acre. The straw was not weighed, but it certainly would not be less than three tons per acre; valuing the grain at twenty measures per rupee, and the straw at 5 rupees per ton, at which price greater part was sold, we have the value of the crop at about 27 rupees per acre. Valuing the manure at 1 rupee per ton, and the cost of cultivation at the usual rates, the total cost of producing the crop of cumboo did not exceed 12 rupees per acre, leaving a balance of rupees 15. One or two other plots of cumboo were sown at about the same time with very similar results.

141. We found the cumboo crop very valuable; it afforded us an abundant supply of green fodder at a time when in this neighbourhood it is usually very scarce. We can always manage to have something green for the stock between the months of October and May; but the great difficulty has hitherto been to find some crop that will yield green fodder during the months of June, July, and August. Of course under irrigation it is possible to grow yellow cholum so as to afford a supply of green fodder throughout the hot season, but there are large tracts of country to which irrigation cannot be applied, in which cumboo will yield excellent green fodder during the season when the stock feeder finds it the most difficult to maintain the condition of his animals.

Shamay (*"Panicum Miliare"*).

142. A piece of poor sandy soil, about two acres in extent, which was last under cholum, was ploughed, harrowed, weeded, and after being manured with ten tons of mixed manure, ashes, fold-yard manure, &c., was sown with fifteen pounds of shamay seed. The seed was drilled in lines twenty-two inches apart.

143. The heavy rain in October gave the crop a good start.

144. The weather was very unfavourable when the seed began to form, and the yield of grain was considerably less than might, under less unfavourable circumstances, have been expected.

145. The crop was cut on the 1st of March, and yielded 541 pounds of grain, worth, at present market price, Rupees 25. The straw would weigh about twenty cwt., and be worth other 5 rupees.

146. Shamay is easily grown; and, though it is not a *very* remunerative crop, it nevertheless is well worth the attention of dry land farmers, who have a very limited number of crops to select from.

147. The total expenses of cultivation did not exceed 15 rupees, leaving a profit of 10 rupees per acre.

Egyptian Clover.

148. This is a white variety of clover; it was obtained from Suez.

149. The seed was sown on the 29th of October, and came up very satisfactorily; it produced a few flowers, but the hot weather experienced about this time injured it very much, and the plants gradually died away.

150. It was cultivated as a dry crop. Probably under irrigation the results would have been different. I intend, next season, to sow some along with hurriallee grass on a new water-meadow I am laying out.

Tobacco.

151. A number of samples of tobacco seed were obtained from the different tobacco-growing districts.

152. A plot of free soil, about three-fourths of an acre in extent, was selected for seed beds. It was deeply ploughed, and was afterwards well dressed with manure, and again deeply dug with digging forks. The soil was thoroughly cleaned and reduced to a very fine tilth. It was then divided in beds three feet broad, with a water channel between each bed.

153. The various samples of seed were sown in the beginning of January. Three lines of seed were sown along each bed; it was sown very carefully and just covered with soil. Usually an ounce of seed is considered enough to produce sufficient plants for an acre of land; but, in this instance, no special care was taken to regulate the quantity sown to the area to be planted. After sowing, the beds were covered with palmyrah leaves, and water was applied by means of watering pots until the plants appeared above the ground. The palmyrah leaves were then removed, and the ground kept wet by allowing water occasionally to pass down the intervening channels. The ground was carefully weeded and kept damp until the plants were about four inches in height, when, for a few days, water was given very sparingly, thus hardening the plants before transplanting.

154. Two or three plots of well manured soil having been prepared, the seedlings were planted out, in lines three feet apart, at intervals of three feet, after which they were watered in the usual manner every three or four days.

155. On one of the plots, the plants having reached a height of eighteen inches have begun to flower, but as fast as the buds appeared they were carefully pinched off, and so also were all suckers or shoots from the stem. The number of leaves was also reduced to six or seven, and, on the larger plants, to nine or ten. On several of the plots the plants were, on March 31st, looking as well as could be desired; but, owing to the parching hot weather of the past few weeks, we have experienced great difficulty in transplanting out the crop. We found that palmyrah leaves answered very well during the first three or four days for protecting the young plants from the effects of the sun. But, on a large area, this is not practicable. We have tried planting out in the evening, but this has not produced much better results. I am afraid that our heavy monsoon would destroy the plant, or I should much prefer to sow before the monsoon, and to plant out immediately after the rains. In Australia and other countries it is usual to protect the young seedlings from the effects of heavy rains by covering them with calico spread on poles; but I am afraid that this would be useless here.

156. Instead of planting in seed beds and afterwards transplanting into the field, I have found it a good plan to sow at once in the field. In a dry hot season this plan has many advantages over transplanting; but there is always a great waste of seed, and it is difficult to raise such good plants as when the nursery plan is adopted.

Yellow Cholum ("Holcus Sorghum").

157. A considerable area of land, chiefly the newly reclaimed land, was sown with this crop. The seed was put down in October in the usual manner.

158. The crop grew very satisfactorily on the less exhausted soils, and produced a very fair yield of excellent seed particularly free from blight. On the exhausted and inferior soils the crop was not allowed to seed; it was cut down whilst green, and used for feeding stock.

159. Harvesting commenced in the early part of February, and was completed by the middle of the month.

160. Nearly 3,000 pounds of good seed is now available for distribution.

161. A large amount of valuable fodder was obtained, which will be of great use during the approaching dry season. The general results were much the same as are detailed in last year's Report.

Egyptian Beans.

162. A supply of this bean, which now is exported so largely to England, was obtained from Suez. They were sown on the 13th of October on a piece of very good soil. They came up very regularly, and, as long as the weather continued showery, looked very healthy, but on the cessation of the showers they became stunted and flowered when only six inches high. The flowers fell off nearly as fast as they appeared. Seeing no prospect of the plants yielding any seed I had the crop ploughed in.

Tenney ("Panicum Italicum").

163. Two plots of very inferior sandy soil, measuring together three-fourths of an acre, were sown with tenney on the 21st of November. The land was manured with about three tons of fold-yard manure. The soil was ploughed, harrowed, and weeded before the seed was sown. The seed used weighed 13¾ pounds; it was sown in drills about twenty-two inches apart. The weather was *very dry* during the whole of the time this crop was on the land, the total rain-fall being only 4·23 inches.

164. The crop was harvested on the 1st of March, and yielded 143 pounds of seed. The weight of straw was not ascertained; it would probably yield one ton per acre, and, as it is worth as much as paddy straw, which it resembles very much in appearance, would be worth 7 or 8 rupees. This would do more than repay expenses, leaving the grain to pay rent, &c. True, this result is not a very satisfactory one; still it is as good as could be expected on such a wretched soil, and under such unfavourable circumstances.

165. On a better soil, and with the usual rain-fall of November and December, the crop will be a remunerative one in this district, and it will alternate very well with gram, indigo, &c.

Rape.

166. A supply of rape seed was obtained from Egypt and Australia. Both lots of seed grew satisfactorily. The seed was sown on the 29th of October in drills twenty-four inches apart. When about four inches high a large number of plants were thinned out, leaving the standing plants about a foot apart. They suffered for a time from the depredation of caterpillars, but soon recovered. The crop, seeing that it was cultivated entirely without irrigation, was a very satisfactory one, but a crop of ordinary Kohl Rabi could have been raised as easily, and certainly would have yielded a much larger quantity of food.

167. All kinds of stock eat the rape readily.

Varagoo ("Panicum Miliaceum").

168. This does not appear to me to be a crop worth much attention. The grain is very inferior, and commands a very small price in the bazaars, while it is a very slow grower, and occupies the land a long time.

169. We had about two acres under this crop last year. The soil was prepared in the usual way, and manured with five tons of fold-yard manure per acre. About twenty-four pounds of seed was sown in drills twenty-two inches apart in the early part of October.

The crop was harvested on the 1st of March, and yielded 456 pounds of grain. The straw would not weigh more than half a ton per acre.

170. This result would do little more than pay expenses.

Cotton.

171. Though our soils are anything but cotton soils, I nevertheless felt justified in setting apart a few acres for the experimental growth of cotton. I had no hope of producing extraordinary results either in yield or quality, still I believed that though our land contains nearly eighty per cent. of sand I would, on a properly manured soil, be able to produce such results as would *justify* the culture of cotton on a very much larger area of country than has hitherto been thought capable of carrying this crop.

172. The fertility of these sandy soils (the result of manure and cultivation) is of rather a fleeting character; and, unless carefully dealt with, will soon be re-placed by sterility. In growing cotton on such soils it, therefore, behoves the cultivator to act with great caution, and so to arrange his cropping that, while he grows as much cotton as possible, he also has a just proportion of feeding or restorative crops.

173. Acting on this view, I selected a 5-acre field and sowed it with alternate rows of maize and cotton. True, I might have attained the same end, that is, provide against the future exhaustion of the soil, by dividing the field in two halves, and sowing one with maize and the other with cotton; however, by alternating the rows of maize and cotton I gained *more than this*. I economised my space, and gave each crop plenty of room without sacrificing any land. It must be remembered that maize has an upright habit in growth, while cotton has a side or lateral growth. The crop was sown in drills three feet apart, certainly much too close had the whole of the land been entirely sown with cotton, still wide enough for the cropping adopted. The maize was first sown in drills six feet apart, and after it had reached a height of six or eight inches, a line of cotton was introduced between each line. The maize was harvested, and the ground ploughed before the cotton had begun to put out its lateral branches.

174. The cotton was sown on the 26th of October, at the rate of about six pounds per acre, in drills six feet apart. It was hoed both by manual and bullock labour. In spite of the very dry weather experienced, and the late season at which it was sown (the seed did not reach us until the last week in October) the crop has thriven very satisfactorily; it is now (March 31st) in full flower, and promises to give a fair yield.

175. To the kindness of Honourable J. D. Sim, C.S.I., I am indebted for a supply of Markham's Yeo Valley cotton. This cotton, I believe, is now in the fifth generation, and is, in the strictest sense, a pedigree cotton. The seed (as there was unfortunately only a very small supply) was sown in chatties in June last; and after being sprouted was planted out in the field at distances six feet apart in each direction on a well prepared plot of land measuring 900 square yards. After the plants had reached a height of five feet it was found that they were too crowded, and about a third were transplanted into another plot measuring 600 square yards. The plants bore transplanting very well; they certainly lost their leaves and a greater part of their greenwood, but they soon recovered, and, though not so large as those in the original plot, are nevertheless very healthy. The plants are now bearing, and promise a fair return. The bolls are very large, and the staple long and silky. I hope from this crop to get as much seed as will enable me next season to sow ten or twelve acres of this valuable cotton.

176. When clearing some waste land near the Farm buildings, Mr. Overseer Wilkins drew my attention to a few cotton plants heavily laden with bolls. I had the seed saved, and afterwards sowed it carefully in a piece of land measuring 270 square yards. A crop of cotton has just been collected of these plants; it weighs * fifty pounds, or 850 pounds per acre in the uncleaned state. The bolls are small, and the staple is short; but it is fine and separates very easily from the seed. This cotton grows very readily, and seems well suited to a low

* May 15th 1871.—Another gathering of cotton has been taken off this plot, making the total yield sixty pounds, or 1,075 pounds per acre, against 313 pounds per acre of clean cotton, and a further gathering is expected.—W. R.R.

order of agriculture. It is, I may here add, as necessary to suit the seed as it is to suit the stock to the agriculture of a district: the same disastrous results will attend the introduction of a high class of plants as of a high class of stock into a district where the agricultural practice is of the lowest type. In this I think we have the explanation of the many failures which have attended the attempted introduction into this country of many well known and valuable varieties of cotton.

Fodder Crops.

177. Instead of there being a scarcity of fodder crops in this country, my experience has satisfied me that the Indian farmer is most bountifully supplied with these crops; indeed in this respect he is much better off than our English farmers.

178. The Indian farmer has a great diversity of fodder crops at his command; he has crops that will grow in the hot weather and in the cold weather; on clay and on sandy soils; under wet or under dry cultivation.

179. In this country a couple of months will suffice to produce a crop that in England could only be produced in double the time. Besides many of these Indian forage crops are very rich in saccharine matter.

180. Amongst the crops which we have experimented with as fodder-producers are yellow cholum (holcus sorghum), Chinese sugar-cane (sorghum saccharatum), cumboo (penicillaria spicata), horse gram (dolicus uniflorus), and common paddy. I have elsewhere given full details regarding our experiments with these crops, and now merely summarize the general results:—

Crops.	Weight per Acre of Green Fodder.	Average Number of Days required to produce a Crop.
	lbs.	Days.
Yellow cholum (dry)	10,000	90
Yellow cholum (wet)	12,000	60
Chinese sugar-cane (dry) ...	20,000	80
Cumboo (dry)	15,000	75
Horse gram (dry)	7,000	70
Paddy (wet)	8,000	65

181. Let these results be compared with the results which attended our attempted cultivation of English forage crops such as clover, lucerne, rye grass, rape, &c., or of English root crops mangold, wurtzel, khol rabi, &c. If half the time and money which has been wasted in the attempt to introduce these crops had been devoted to the improvement of indigenous or tropical forage crops, the Indian stock-breeder or feeder would have been in very different circumstances to those in which we now find him.

Cropping.

182. The following examples of dry land cropping will give some idea of the capabilities of these sandy soils when fairly treated:—

Field No. 18, *East side.*

Date of Sowing.	Date of Reaping.	Nature of Crop.
3rd August 1869.	13th October 1869.	Horse Gram cut for fodder.
15th October „ ...	6th January 1870.	Bangalore Maize.
18th January 1870.	12th March „	Horse Gram cut for fodder.
16th June „ ...	23rd September „	Gingelly.
15th October „ ...	3rd February 1871.	Yellow Cholum.
3rd March 1871.	.....	Tobacco.

183. In this instance the land bore six crops in twenty-one months.

184. The following shows the cropping and yield per acre of another piece of similar land:—

Field No. 18, *West side.*

Date of Sowing.	Date of Reaping.	Nature of Crop.	Yield per Acre.	
			Straw.	Grain.
			lbs.	lbs.
2nd August 1869...	13th October 1869 ...	Gram fodder	7,582	...
25th October „ ...	8th February 1870...	Queensland Maize ...	7,543	836
14th June 1870 ...	7th September „ ...	Cumboo	6,000	668
10th October „ ..	25th January 1871...	Sorghum	21,096	1,692
28th February 1871...	.....	Tobacco	...	...
		Total ...	42,221	3,196

Effects of Cultivation.

185. There is a marked change in the appearance of our soils. Soils which when reclaimed only two years ago could scarcely rear a blade of grass, and consisted almost entirely of blowing sands, might now, as far as appearance goes, be classed as fair arable soils. Much of this is certainly due to heavy dressings of tank mud and burnt earth; still, I think, much more is due to deep cultivation and the liberal use of fold-yard manure. The mere cultivation of a sand, that is, the mere stirring of its particles, will do little to improve it; it is only when combined with manure that any real good results. On a good arable soil superficial culture with imperfect implements and without manure continued for a time will exhaust the upper few inches of the soil; still, by cultivating deeper, and by using better-constructed tools, it is always within the means of the cultivator to bring up to the surface a portion of the lower or less exhausted soil, and thus restore, in a measure, the fertility of his land; but the cultivator whose soil consists of sand resting on a sandy sub-soil which is even poorer and more hungry than the upper soil cannot effect any good in this manner. In his case deep cultivation without manure will only make matters worse.

186. The cultivator of a sandy soil such as this must put into his soil the food on which his crop must feed. He has the manufactory and the manufacturing appliances, but he needs the raw material for manufacture. The phosphoric acid, the lime, the potash, &c., must be put into the soil before plants needing these foods can be profitably cultivated. But this is not all; he must endeavour to alter the physical state of his soil so as to lessen the evil effects of droughts and heavy falls of rain which alike act so injuriously on very sandy soils.

187. It is useless to attempt by a single operation to fertilize a barren soil. Such an attempt would end in a great waste of money. The work of improvement requires time, and it can only be effected in stages.

188. Our plan has been to apply a slight dressing of manure to *each* crop, and to crop the land as frequently as possible with green crops. These crops, being cut in the green state, leave a great quantity of roots, &c., in the ground, and add greatly to the quantity of organic matter in the soil. True, we might have effected this more quickly by ploughing in the green crop, but the stock-feeder on land like this has seldom such a superfluity of green food as to justify this procedure.

189. Another improvement, which has greatly benefited our land, is the open drains which have been laid out in different directions for carrying off surplus water during the rains. The more I see of dry land farming in this country, the more am I convinced that our crops suffer more from *too much* water than from *too little*. Water, in a stagnant condition, is more injurious than a drought.

190. A drought may only affect one crop, but stagnant water in the land may affect many crops.

191. Deep cultivation with proper manuring has greatly increased the capillary action and absorptive powers of our soil. Crops on this Farm continue fresh and green long after the crops on neighbouring farms are scorched and dried.

192. The usual system of dry land management in this district, which allows of crop after crop being taken off the land without a particle of fold-yard manure being used, and is content if the cultivation of the soil is confined to a surface-stirring not over three inches in depth, is most suicidal. The great object of the cultivator of dry land should be to enable his soil to retain as much water as possible without its being stagnant or being actually visible to the eye. He should take care that no water remains on the surface of the land, and by deep ploughing and the liberal use of organic manures increase, as much as possible, the porosity of his soil; instead of this the result of his operations is that his soil is rendered as little porous as possible; his lands during the rains are flooded and swampy, while during the dry weather they are baked and cracked. A soil which only contains twenty per cent. of water may be wet and swampy, while another which contains as much as thirty per cent. may appear much the driest. During very dry weather the crops on the former will suffer greatly, while on the latter the crop may thrive and suffer little.

Implements and Machines.

193. The large water-lift was taken to pieces, the elevator was sold to the Madras Municipality, and the shafting and gearing was returned to the Public Works Stores. The wind-mill and pump, the paddy-huller, the bone-crusher and the rotary screen have been transferred to the Public Works Department.

194. A quantity of costly English agricultural machinery was received from the Oossoor Farm in September last, the details are as follows :—

3 Large corn drills.	2 Horse gears.
4 Winnowing machines.	2 Reaping machines.
2 Threshing machines.	

195. The winnowing machines, one of the threshing machines and a reaping machine can be utilized; but the remainder of the machinery is useless here, and I fear useless in the present condition of Indian agriculture. Several of these machines are excessively heavy and cumbrous. Where labour is costly these machines may be utilized; but they are useless to the Indian ryot in his present circumstances. If it will not pay to export them, there seems to me no other alternative than to take them to pieces and use them up in constructing simpler machines.

196. It is very undesirable that any of these machines should be sold amongst Indian ryots; should any wealthy cultivator be sufficiently enterprising to purchase any of them, the experiment could only end in failure, and be more productive of harm than of good.

197. The following is the list of machines, &c., sold during the twelve months, and the districts into which they were sent :—

	Districts.
2 Reaping knives...	... Tanjore.
1 Iron plough ...	... North Arcot.
2 Chaff-cutters ...	... North Arcot.
1 Maize-sheller ...	... North Arcot.
25 Reaping knives...	.. Neilgherries.
1 Cake-crusher ...	... Neilgherries.
5 Reaping knives...	... Madras.
1 Iron plough ...	... North Arcot.
1 Chaff-cutter ...	... North Arcot.
1 Reaping knife ...	... Coimbatore.
1 Hand hoe ...	... Coimbatore.
2 Scythes... ...	... Madras.
2 Iron wheel-ploughs	... Coimbatore.
1 Set of iron harrows	... Coimbatore.
1 Iron swing-plough	... Coimbatore.
1 Chaff-cutter ...	... Madras.

	Districts.
1 Iron plough ...	... Rajahmundry.
1 Iron plough ...	... Tanjore.
1 Water-lift ...	... Madras.
1 Iron grubber ...	... Coimbatore.
1 Norwegian harrow	... Coimbatore.
2 Iron ploughs ...	... Coimbatore.
12 Grass knives ...	... Madras.
1 Iron plough ...	... Madras.
1 Maize-sheller ...	... Coimbatore.
1 Iron plough ...	... Coimbatore.
1 Iron cultivator ...	... Coimbatore.
2 Wheel-barrows...	... Madras.
2 Grass knives ...	... Coimbatore.
1 Water lift ...	... Ganjam.
1 Water-lift ...	... Bombay.

198. Many of these were purchased as patterns from which others could be made by the Native smiths and carpenters of the district.

199. A special grant of 1,500 rupees was made to the Farm on the 26th March 1868, for the purpose of keeping up a stock of implements and machines for sale. Under these arrangements fourteen ploughs, one-and-a-half set of harrows, two water-lifts, three maize-shellers and six chaff-cutters have been disposed of in the Presidency. At the present time we have stock on hand worth Rupees 180, a balance of Rupees 1,061-14-5 in cash, and have advanced Rupees 265-3-1 to an American Firm for agricultural machines, making a total amounting to Rupees 1,507-1-6. The details of income and expenditure under this head will be found in the Appendix.

200. An Implement Workshop was commenced about three months ago. In it three carpenters and three smiths are employed in making ploughs, harrows, carts, winnowing machines, wheel-barrows, seed-drills, scythe-blades, grass knives, &c., for sale, besides executing all repairs needed either on account of these Farms or the general public. We have long felt the need of some such establishment. It was almost impossible to get repairs executed, and there was always a great waste of time and a heavy bill to pay. English implements, being made for horse-power generally, need to be altered before they are suited for cattle-power, and for the very primitive mode of yoking adopted here. These alterations could not be satisfactorily performed by men who had no knowledge of the practical working of these implements. Besides our experience in the field is constantly suggesting modifications in the working parts which could only be executed on the spot. We now have facilities to experiment with a view to determine the shape or description of implement best suited to the peculiar circumstances of the Indian ryot, and last, but not least, we can prove to the Indian cultivator that his local smith and carpenter can make up or repair any of our most useful agricultural implements.

201. In the manufacture of implements and tools we use no castings of any sort, and thus remove one of the chief objections urged by many ryots against our English implements. The iron parts being all of wrought iron, repairs can be easily executed by any Native smith. Iron castings, though cheap and effective, are a nuisance in a country where castings cannot be made. The unfortunate cultivator whose implement is laid aside because a casting is broken often has to choose between either abandoning the implement altogether, or spending as much as it is worth in conveying it to and from the nearest town in which the casting can be done, while he is put to a great deal of trouble and inconvenience.

202. The accounts of these workshops are kept separately. The establishment will be self-supporting: no profit is sought; only the actual cost of the implement, plus five per cent. to meet contingencies; the sole object being to introduce a better class of implements and tools amongst the ryots.

203. During the three months this establishment has been in existence we have expended as follows:—

	Rs.	A.	P.
Workshop buildings	357	12	9
Plant	140	4	0
Materials and labour	617	13	0
Machines	874	12	0
	1,990	9	9

and we have received—

Loan from Experimental Farm as Capital... ...	883	1	5
For machines, &c.	875	9	0
Materials and labour...	231	15	4
	1,990	9	9

Liabilities.

	Rs.	A.	P.	Rs.	A.	P.
Experimental Farm loan	883	1	5			
Out-standing bills	110	5	4			
				993	6	9

Assets on 31st March 1871.

Buildings	357	12	9		
Plant	140	4	0		
Materials, &c.	169	7	11		
Stock on hand...	140	15	6		
Out-standing bills	136	14	9		
Loss	47	15	10		
				993	6	9

Five per cent. is charged on the capital invested.

204. The deficiency of Rupees 47 arose, I think, in the cross transactions between the Experimental Farm and the Workshops at the commencement of this new establishment, when the plant of the former establishment was taken over at a valuation. And doubtless many little odds and ends consequent on the starting of a new establishment were lost sight of in valuing the assets.

Ploughs and Ploughing.

205. The ploughs chiefly used here are those made by Messrs. Ransome and Sims, of Ipswich, and Messrs. Howard and Co., of Bedford. Most of these are single-horse or pony ploughs. Those by Messrs. Howard and Co. are made of iron; they weigh eighty-five pounds, and seem well suited for light soils. They cost about 35 rupees each delivered here. One of these ploughs, on a free sandy loam, gave the following results when tested by the dynamometer:—

Complete with Wheel and Coulter.

	lbs.
Ploughing a furrow 4 inches deep and 8 inches wide ...	168
Ploughing a furrow 6 inches deep and 9 inches wide ...	280

Without a Coulter.

Ploughing a furrow 4 inches deep and 8 inches wide ...	186
Ploughing a furrow 6 inches deep and 9 inches wide ...	308

Without either Wheel or Coulter.

Ploughing a furrow 4 inches deep and 8 inches wide ...	280
Ploughing a furrow 6 inches deep and 9 inches wide ...	336

206. When drawn along an empty furrow the dynamometer registered fifty-six pounds.

207. Thus the actual draught of one of these ploughs, when ploughing a furrow four inches deep and eight inches wide, is only 168 pounds; of this fifty-six pounds, or about thirty-three per cent., is due to the weight of the implement.

208. When used without the wheel as a "Swing" plough the draught was increased sixty-six per cent. Ransome and Sims' ploughs have long been used on this Farm. The light iron ploughs made by this Firm are very similar to those sent out by the Messrs. Howard and Co., and do their work in an equally satisfactory manner. We have found one of their large ploughs—The New castle—very useful during dry weather, when the light plough would not penetrate the ground. This plough weighs 200 pounds, and though much too heavy for ordinary work, is nevertheless very useful under the circumstances just described. With this plough the dynamometer gave the following results:—

Complete with Wheel and Coulter.

	lbs.
Ploughing a furrow 4 inches deep and 10 inches wide ...	252
Ploughing a furrow 6 inches deep and 10 inches wide ...	392

Without a Coulter.

	lbs.
Ploughing a furrow 4 inches deep and 10 inches wide ...	280
Ploughing a furrow 6 inches deep and 10 inches wide ...	406

Without a Wheel or Coulter.

Ploughing a furrow 4 inches deep and 10 inches wide ...	336
Ploughing a furrow 6 inches deep and 10 inches wide ...	560

Complete.

Running in an empty furrow	112

209. Thus, when ploughing with a furrow four inches deep and ten inches wide, forty-five per cent. of the draught registered is due to the weight of the implement.

210. A combined plough, that is one made of wood and iron, which was made on the Farm, was tested in the field in which the iron ploughs were worked, with the following results :—

	lbs.
Ploughing a furrow 4 inches deep and 8 inches wide ...	182
6 inches deep and 9 inches wide	280
Running in an empty furrow	56

211. Thus thirty-two per cent. of the draught registered is due to the weight of the plough.

212. It is a swing-plough with wooden stilts and pole, and the whole of the iron-work mould-board included, consists of malleable iron. We thus avoid the loss and annoyance the breakage of castings so frequently causes. Wherever there is a village smith the plough can be made up or repaired. This plough only weighs seventy pounds, and can be conveniently carried from field to field, and it is so constructed that the driver while working is always close to his cattle.

213. To plough an acre of land six inches deep and nine inches wide with one of these ploughs the cattle will have to travel eleven miles and the plough will raise and turn over 869 cubic yards of earth in the operation.

214. An ordinary Native plough was tested in the same field ; the following is the result :—

Ploughing 5 inches deep and 6 inches wide at surface of ground, and one inch wide at bottom of furrow...	140 lbs.

215. To plough an acre of land with this plough, the cattle will have to travel seventeen miles, while only 400 cubic yards of earth will be turned over.

216. The foregoing experiments prove that one of these combined ploughs will, in ploughing an acre of land, turn over nearly 900 cubic yards of earth, while the cattle will only have to travel eleven miles, and will exercise a traction force equal to 280 pounds. A Native plough will only require half this draught, though it will have to travel seventeen miles to plough an acre, and will only turn over 400 cubic yards of earth.

217. The Native plough cuts out a triangular furrow, while the furrow made by the English plough is rectangular. The result is that while the English plough cleans out its furrow and leaves the undersurface level, the Native plough leaves a ridged undersurface nearly half of the land being unploughed.

218. Again the English plough inverts the soil and brings up each time a fresh surface, while the Native plough, or cultivator as it should be called, leaves the soil in its original position.

219. It may be contended that, as the Native plough only does half of the work, and only needs half of the traction force required by the English plough, the ryot has only to pass his plough twice through his land to do the work of an English plough ; but this is not the case ; it will be necessary for him to plough his land over *several* times before it is

in the state in which it is left by the English plough. Besides, there are several agricultural operations which the Native plough, in its present shape, never can perform.

220. And again one English plough, with one man and an average sized pair of cattle, will do the work of two Native ploughs, two men, and two pairs of cattle. Thus, the ryot for each English plough he uses can dispense with the services of one plough-man and one pair of cattle. True, he may have to keep his cattle a little better than at present, but this will be money well expended.

221. I may here remark that these deductions founded, as they are, on experiments made on a particular class of soil, can have no bearing whatever on soils of a different character.

222. The cost of an English plough need not now create any apprehension in the mind of the ryot. The combined plough I have just been comparing with the Native plough was made on this Farm, and only cost 15 rupees; indeed we are making them up at this price; a ryot, with his own wood and cheap labour, could probably make them up at 10 or 12 rupees each.

223. These combined ploughs are as well-suited for wet cultivation as for dry cultivation. Indeed I am acquainted with no plough so well suited for paddy cultivation. I have tried several forms of the Native plough, and have even tried one with a mould-board added, but none worked so satisfactorily. One of these combined ploughs, when ploughing in puddle for paddy, gave the following results :—

	Draught.
Ploughing a furrow 6 inches deep and 9 inches wide ...	168 lbs.

While the Native plough gave the following results :—

Ploughing a furrow 6 inches deep and 6 inches wide at surface, and 3 inches wide at the bottom of the furrow...	200 „

224. The very defective construction of the Native plough adds *very* greatly to its draught. Thus, in the hinder part of the plough there is a flat surface measuring eight or ten inches placed at right angle to the line of draught; this not only offers a great deal of resistance in the passage of the plough through the soil, but in wet land such an amount of mud collects on it and in the angle below the pole, that the plough is drawn through the land with great difficulty. This is not the case with ploughs provided with English shaped mould-boards; these mould-boards offer no points for the accumulation of mud, and the plough cleans itself as it proceeds.

225. A ploughing match was held on the Farm last season amongst the Native ploughmen. All used English ploughs of the Messrs. Howards' or Messrs. Ransomes' make. The soil was a light sandy loam. Each of the plots contained 1,000 square yards. The following are the results :—

	Minutes.
1st man ploughed his plot in	81
2nd do. do.	92
3rd do. do.	88
4th do. do.	108
5th do. do.	109
6th do. do.	127

226. The land worked very freely, and the work was done in the early morning. The average width of the furrow was nine inches, and the depth between five and six inches. The work was performed in a very satisfactory manner.

Dynamometer Tests.

227. The dynamometer has been of great value during my recent investigations into the relative capabilities of certain agricultural implements. Amongst many others the following results were obtained :—

Iron Harrows.

Dead weight	84 lbs.
Breadth	7 Feet.
Draught	224 lbs.

Iron Harrows.

Dead weight	62 lbs.
Breadth	4½ Feet.
Draught	168 lbs.

Wood Cultivator.

Dead weight	80 lbs.
Breadth	27 Inches.
Draught when cultivating 5 inches deep	280 lbs.

Iron Drill Cultivator.

Dead weight	90 lbs.
Breadth	17 Inches.
Draught when cultivating 3 inches deep ...	200 lbs.

A Country Cart.

Dead weight	568 lbs.
Draught when drawn along a good level road empty	42 „
Draught when drawn along a good level road with a load of 400 bricks weighing 1,500 pounds ...	84 „
The same when drawn along an ungravelled road similar to the sidings on the roads in this district	356 „

A Cart built on the English Plan.

Dead weight	1,074 „
Draught when drawn along a good level road empty	56 „
Draught when drawn along a good level road with a load of 400 bricks weighing 1,500 pounds	135 „
The same when drawn along an ungravelled road similar to the sidings on the roads in this district	356 „

Overseer.

228. The Overseer alluded to in last Report has left the Farm. Mr. F. Wilkins, who, as an Apprentice, had been employed for some time, was then appointed Overseer. He held the appointment until the first week in July, when he was appointed Overseer on the Model Farm, and was succeeded by Mr. J. G. Young, who also had received an agricultural training on the Farm. Though not so well up in agriculture as Overseer Wilkins, he nevertheless has managed very satisfactorily, and promises, with more experience, to make an excellent Overseer. His practical knowledge of mechanics has been turned to good account in the Implement Workshops. He is a good accountant, and has been of great assistance to me.

Ploughmen and Labourers.

229. The skill of our ploughmen is greatly improved; many of them can now handle their ploughs in a very creditable manner. They understand their construction, and can adjust them to the work they are called upon to do. They can also work the reaping machine, the threshing machine, and other agricultural machines and implements generally used here.

230. During the past year we have had a number of ploughmen under training; amongst others the following Noblemen and Gentlemen sent men to be trained :—

The Maha Rajah of Vizianagram,
The Rajah of Vencatagherry,
The Zemindar of Kalastry,
The Zemindar of Ramnad, and
The Jaghirdar of Arnee.

231. Some of the men remained six months on the Farm, while others a shorter period. This is a very satisfactory movement, and worth every encouragement. The field labourers are also becoming more skilful; many of them can handle a digging fork or a dung fork very satisfactorily, and some can use the hedge knife, the sheep shears, and the shovel as well as any English Farm labourer. Their attendance is more regular, and they evince a greater readiness to do work which before was considered detrimental to their caste.

Seed Distribution.

232. The following quantities of agricultural seeds were distributed gratuitously during the past year :—

	lbs.
Carolina paddy	11,203
Maize	1,238
Chinese sugar-cane	159
Yellow cholum	412

233. The Farm paid all the expenses incurred in packing the seed, and also, in most instances, the cost of conveying it to its destination.

234. The seeds were distributed in nearly every Collectorate in this Presidency.

235. Instructions for the guidance of experimenters were issued along with the seeds, whenever such information was needed.

236. There now remains in the granary available for distribution the following quantities of seeds :—

	lbs.
Carolina paddy	1,365
Maize	840
Chinese sugar cane	341
Yellow cholum	1,088

237. The Appendix contains a detailed list in which is recorded the localities in which the seed was distributed.

(Signed) W. R. ROBERTSON.

VALUATION of Live and Dead Stock at the Government Experimental Farm on the 31st March 1871.

Cattle.

		Rs.	A.	P.	Rs.	A.	P.
3	Bulls	300	0	0			
27	Working cattle	1,578	0	0			
21	Feeding cattle	388	0	0			
51					2,266	0	0

Sheep.

10	Rams	123	0	0			
55	Ewes 54 Lambs	400	0	0			
22	Wethers 15 Gimmers 30 Ewes	200	0	0			
186					723	0	0

Pigs.

	Rs.	A.	P.	Rs.	A.	P.
2 Boars	30	0	0			
8 Sows	150	0	0			
19 Sucking pigs	50	0	0			
29				230	0	0
1 Horse				150	0	0
Rabbits				25	0	0
Poultry				30	0	0

Manure.

Bones and guano	100	0	0			
Fold-yard manure	80	0	0			
Poonac cake	10	0	0			
				190	0	0
Straw and other fodder				250	0	0

Cattle Food.

4,474 lbs. of cake	46	15	7			
5,680 „ of gram	71	0	0			
1,000 „ of yellow cholum	25	0	0			
				142	15	7

Farm Seeds.

2,180 lbs. of cumboo	31	8	0			
1,984 „ of yellow cholum	60	0	0			
779 „ of chumba paddy	10	8	0			
406 „ of sorghum	13	0	0			
571 „ of shamay	25	0	0			
450 „ of ragi	9	0	0			
250 „ of green gram	10	0	0			
69 „ of rape seed	10	0	0			
143 „ of tenney	5	0	0			
Other seeds	25	0	0			
				199	0	0
Implements and tools as catalogued in Inventory				7,566	0	0
Total ...				11,771	15	7

(Signed) W. R. ROBERTSON.

List of Machines, Implements, and Tools, &c., belonging to the Farm.

1 Portable steam engine, 8-horse power, by Ransomes and Sims.
1 Set of steam ploughing and cultivating apparatus, tackle, windlass, porters, &c., by Fowler and Co.
1 Chaff-cutter and universal mill, with bullock-power, by Ransomes and Sims.
1 Threshing machine, with a bullock-power, by Emery Brothers.
1 Threshing machine, by Dray Taylor and Co.
1 Threshing machine, with bullock gear and carriage, by Ransomes and Sims.
1 Threshing machine, with bullock gear and carriage, by Garret and Co.
1 Winnowing machine, by Dray Taylor and Co.
3 Winnowing machines, by Garret and Co.
1 Winnowing machine, by Ransomes and Sims.
1 Winnowing machine, by R. T. Smith.
1 Winnowing machine, by Hornsby and Sons.
3 Reaping machines, by Samuelson and Co.
1 Drill sowing machine, 8 rows, by Garret and Co.

2 Drill sowing machines, 13 rows, by Garret and Co.
1 Wood drag-harrow, by Experimental Farm.
2 Sets of iron prong-harrows with swingle-trees, by Ransomes and Sims.
2 Iron chain harrows.
1 Iron grubber.
1 Combined grubber.
4 Bullock hoes.
2 Bullock ploughs, by Howards and Co.
1 Bullock plough, by School of Arts.
2 Bullock ploughs, by Mint.
2 Bullock ploughs, by Ransomes and Sims.
1 Double mould-board plough.
1 Large plough with 2 wheels, by Ransomes and Sims.
1 Swing-plough, by Roorkee Workshop.
1 Mould-board country plough, by Experimental Farm.
1 Wood swing-plough, by Ransomes and Sims.
1 Wet-land plough, by Experimental Farm.
1 Country drill, by Experimental Farm.
1 Wood field roller.
1 4-wheel waggon.
1 Stone trolley.
1 Root-pulper, by Ransomes and Sims.
3 Country carts.
1 Water cart.
1 Sewage cart, by Gun Carriage Works.
1 Maize-sheller, by Ainsworth and Co.
1 Corn drill.
1 Barrow drill, by Experimental Farm.
1 Rain gauge.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
1 English ladder.
1 Norton's tube-well with a rotary motion.
1 English grind stone.
1 Farm bell.
1 Wheel hand-hoe.
11 Cattle yokes.
1 Gram mill, by Ransomes and Sims.
2 Single bullock carts.
1 Overhead, bullock-power, with shafts and gearing.
1 Sugar-cane mill.
1 Californian pump.
1 Archimedian pump.
1 Maize-sheller, by Ransomes and Sims.
1 Cake-crusher.
2 Steaming apparatus, Richmond and Chandlar.
1 Pump, by Roorkee Workshop.
2 Chaff-cutters, manual-power.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon and Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
6 English carts.
1 Malabar spoon bale.
1 Waterproof cart-cover.
1 Sack-barrow.
1 Portable scale with weights.
6 Piccotah buckets.
2 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
15 Wheel-barrows.
3 Hay frames for carts.
1 Farm clock.
3 Tables.
10 Chairs.
1 Writing desk.
2 Almyrahs.
1 Iron cash-chest.
1 Dynamometer.
1 Surveying level with stand-staves, &c.
1 Set of bottle levels.
Chemical apparatus, mortars and pestles, glass-beakers, &c.
30 Feeding tubs.
5 Metal feeding troughs.
3 Scythes.
2 Manure drags.
2 Bengal picks.
2 Dutch hoes.
2 Bengal hoes.
11 Hand hoes.
6 Forks of sorts.
9 Iron rakes.
19 Mamooties.
A number of spanners.
2 Stubble rakes.
2 Hammers.
6 Hatchets.
4 Jumpers.
5 Quarring crowbars.

17 Crowbars.
24 Picks.
4 Mattocks.
2 Hedge shears.
2 Billhooks.
1 Iron reel.
5 Grass knives.
3 Manure dung forks.
16 Digging forks.
6 Shovels.
2 Spades.
4 Sets of bullock harness.
1 Cart saddle.
Water bridle, rug, and nundah for horse.
2 Surveying chains with pins.
1 Iron cistern.
A quantity of wire, rope, and a large number of details belonging to steam plough.
72 Volumes of agricultural works.
39 Specimen seed bottles.
2 Hedge knives.
5 Pairs of thorn pincers.
1 Ear punch for marking sheep.
1 Branding iron for marking sheep.
120 Empty sacks.
1 Marcal, one half-marcal, and one measure
6 Scythe stones.
2 Weeding spuds.
2 Pairs of sheep shears.

(Signed) W. R. ROBERTSON.

Tools, &c., belonging to Implement Workshops.

1 Large anvil.
1 Circular anvil.
1 Small anvil.
1 Portable bellows.
1 Bench and two vices.
1 Pair pincers.
1 Shoeing rasp.
1 Three-cornered file.
2 Round files.
4 Flat files.
1 Set five-taps stock and dies.
2 Hand vices.
1 Screw plate.
5 Punches.
1 Iron brace and two bits.
5 Chisels.
3 Flat chisels.
1 Counter sinking punch.
1 Pair of calipers.
10 Pairs of tongs.
2 Sledge hammers.
4 Hammers.
1 Iron square.
1 Hammer and chisel.
Several spanners.
2 Sets squares.
1 Angle square.
4 Augers.
1 Cross-cut saw.
1 Pit saw.
3 Hand saws.
2 Adzes.
36 Bits and one brace.
1 Spirit level.
6 Gimlets.
1 Cold chisel.
4 Wood chisels.
2 Jack plains.
1 Hammer.

(Signed) W. R. ROBERTSON.

REPORT ON THE ESTABLISHMENT OF A MODEL FARM ON THE GOVERNMENT FARM ESTATE.

238. The northern portion of the Estate which, since the Committee took charge of the property has always been rented by small tenants, was, in the early part of July last, set apart for the purposes of a Model Farm.

239. The condition of the land was very unsatisfactory; the greater portion was overgrown with weeds and bushes, and a very considerable area had been appropriated by the public. Not only was the appearance of the land very discreditable; but, owing to the great amount of trespass caused, it was a nuisance to the neighbouring Experimental Farm.

240. At no time had the rents been regularly paid; but it had become very difficult to collect even a very small proportion. It was in vain that large remissions had been made; the renters were men of very small means, and several were without any agricultural training.

241. Most of them held under a five-years' lease, two years of which were unexpired. During the early part of last year several of them petitioned to be allowed to relinquish their land; but it was not until the month of July, when a general petition was received from all the tenants, that, seeing no other chance of bettering matters, it was determined to write off all arrears, and to take the land into our own management.

Area.

242. The total area thus set apart for a Model Farm is 115 acres, of this area seven acres is occupied by the nullah, roads, buildings, &c. It is bounded on the north by the Cutcherry compound, on the west by the Mount Road and the Roshanbaugh village, on the south by the nullah and Commissariat slaughter-ground, and on the east by the river Adyar.

Soils, &c.

243. Nearly thirty acres can be irrigated; twenty acres from the Mambalam tank by gravitation, and the remainder from the wells by picottahs, &c. The soils on this part of the Farm differ very little, the majority consist of sandy loams varying in colour from a yellow to a reddish brown.

244. The dry soils differ greatly: about thirty acres is a blowing sand of the lowest type; about forty acres is a sandy loam of fair quality, free and easy to work, but in a very impoverished state; the remainder is a stiffish loam, with a good deal of clay in its composition and a considerable amount of the red oxide of iron.

Rent.

245. To put the undertaking on a thoroughly commercial footing it was determined to fix the rent at the average yearly income of the previous four years, and to deduct the annual value of the fruit trees which had to be removed to facilitate the work of reclamation.

246. The average income of these four years was found to be Rupees 535.

247. The sale of the fruit-tree timber realized 2,721 rupees, and its annual value was estimated to be Rupees 150. This sum deducted from Rupees 535 leaves Rs. 385, the annual rent of the land.

248. In addition to the land-rent there is rent charge on the capital expended by the landlord on improvements; this is assessed at 7½ per cent. per annum, and will be repaid over 24 years. The total amount expended on landlord's improvements amounts to Rupees 3,522-11-2; with the cost of some works yet to be done the total will probably reach Rupees 3,800, this at 7½ per cent. per annum will make a rent charge of Rupees 285, or with the land-rent a gross rental amounting to Rupees 670. But in addition to this we have to pay 5 per cent. on the capital employed in working the place, &c., which will make our annual liabilities under "rent and interest" to amount to about Rupees 820, or above Rupees 7 per acre.

Buildings.

249. The buildings are situated in a central part of the Farm, and in close proximity to the main road. The site is rather above the level of the surrounding land, and is well drained by natural drainage.

Overseer's Residence.

250. This is a small three-roomed cottage: the rooms are small, but the house is furnished with back and front verandahs. It is a brick building with a tiled roof. The foundations are laid with chunam. The walls, from about one foot above the ground, consist of brick laid in mud; they are pointed on the outside and plastered inside with chunam. The verandahs are supported on brick and chunam pillars, and the floors are paved with tiles.

Cattle Sheds.

251. These are similar to those on the Experimental Farm. The roofs are supported on brick and chunam pillars, and consist of thatch over palmyrah rafters. The internal divisions and the outside fencing consist of palmyrah rails and posts. All the wood-work was thoroughly painted with coal tar. The sheds are divided into thirty-one loose boxes, each containing eighty superficial feet. The floors of the boxes are sunk two feet below

the level of the surrounding ground. The straw-house, cart-shed, and pig-styes are similarly built.

252. The grain-store and the poultry houses are built with materials similar to those used in building the Overseer's cottage. The total cost of these buildings was Rupees 1,757-7-8.

Clearing and Levelling.

253. The timber was all sold by auction. The purchasers felled, and removed it at their own cost. The surface of the land was very irregular. Attempts had evidently been made at different times to bring portions under cultivation; many of these attempts had been made in injudicious places; the result was a broken surface on which it was scarcely possible to find a block of five acres fit for immediate cultivation. To bring this surface into a form fit for arable culture it was necessary to level many hollows and remove many hills, and, although a "*Commercial Farm,*" we had no alternative but to perform a good deal of work of an unremunerative character, simply to give a more civilized aspect to the place. Its appearance is still far from satisfactory; but the further improvement must be the work of time and the result of a better system of cultivation. A Farm created from the jungle, and which has only been in existence about four months, can scarcely afford any very pleasing landscape effects. The total cost incurred for levelling was Rupees 1,204-15-5.

Roads.

254. It was necessary to make several roads, in order that all parts of the Farm might be easily approached. The total length of these roads is 1,650 yards. They vary in width from six to nine yards. They are the ordinary ungravelled Farm roads, protected on either side by an open drain. For the convenience of the public it may afterwards become necessary to gravel these roads; but this can scarcely be the duty of a "Commercial Farm." The total cost of these roads was Rupees 408-1-10.

Fences.

255. Eight hundred yards of fence was erected on the side of the Mount Road. This consists of an open ditch and a raised bank. A corkapilly fence has been planted on the inner side, and the outside is protected by an aloe fence. About 1,200 yards of internal fences have been planted; they consist of corkapilly. The total cost of fencing was Rupees 142-11-3.

Live Stock.

256. Nine pairs of draught cattle are now employed on the Farm. This number will probably be too great for its future requirements, that is, after it has been brought regularly under cultivation; but for the next year or two, while we are carting manure, &c., the number will not be too great.

257. A number of cattle were fattened and sold; the general results were satisfactory. A larger number would have been fattened had there been any certainty that we would have sufficient fodder.

258. Sheep and pigs will be added to the live stock of the Farm as soon as arrangements can be completed for their accommodation.

Crops.

259. Owing to the very late season at which we commenced with the Farm, we were not able to get all the land ready in time for seasonable sowing. On the piece of land completed first we obtained *two crops of paddy*, and we might have done the same with *all the wet land* had it all been ready for cropping. We may fairly estimate that this second crop would have been worth from 150 to 200 rupees to us.

260. Having no manure, and the land being in a very impoverished state, we had to content ourselves with a low class of crops.

Manure.

261. We had no fold-yard manure, excepting what our loose boxes provided.

262. Ashes from the neighbouring village, tank mud, brick-yard refuse and a quantity of yercum leaves were all the other manures obtainable.

263. Our loose boxes promise to yield a good supply of valuable manure; the only course open to us is to grow a large area of green crop for cattle and sheep food, and to make the place supply its own manure as soon as possible. It is useless to trust to purchases. The only fold-yard manure available is wretched stuff, and not worth carting besides being frequently full of weed seeds.

264. I propose next season, as the experiments on the Experimental Farm were so satisfactory, to use a considerable quantity of saltpetre, lime, and bone dust.

Implements and Machines.

265. Our stock of implements and machines is far from being complete. I propose making up in the Implement Workshops for this farm two or three ploughs, two or three carts, a drill cultivator, a seed drill, a winnowing machine, &c., probably the cost of additional machines will add a couple of hundred rupees to the amount of the tenant's capital.

Overseer.

266. Mr. Overseer Wilkins was appointed to take charge of this Farm on the 4th of July 1870, and to his energy and practical knowledge must be attributed a very considerable proportion of the success that has so far attended this enterprise. I am glad to have this opportunity of expressing the satisfaction I have experienced in his general conduct, and with the readiness with which he has always carried out my wishes.

Labourers.

267. Nearly the whole of the labour performed in this farm has been done by Wudders, the ordinary tank-digger caste. Some of these men are now excellent ploughmen, and can perform many agricultural operations in a very creditable manner. This is the more remarkable as the members of this caste generally object to perform any work that cannot be done with the mamooties, and they possessed no knowledge whatever of agricultural work when we commenced the Farm six months ago. They are good workmen, and will make useful Farm labourers. They live in a village on the Farm, so are close to the scene of their daily labours.

Financial Results.

268. A balance of Rupees 25-5-0 to the credit of the Farm, after paying rent, rent charge, interest, and all other charges, is a much better result than I expected. Only a very small proportion of the land was fully cropped, and there are so many extra charges on the opening of a new farm.

(Signed) W. R. ROBERTSON.

Model Farm Receipts.	RS.	A.	P.	*Model Farm Payments.*	RS.	A.	P.
From Experimental Farm—Tenant's Capital	2,776	9	10	Cattle	1,614	3	0
Cattle	403	1	9	Labour	1,219	0	2
Guava Fruit	384	0	0	Implements, &c.	461	9	0
Paddy	359	1	7	Cattle Food	267	11	9
Sundries	101	10	3	Seeds	109	9	7
Hay and Grass	42	8	0	Mango, Cocoanut, and other Fruit Trees	76	10	0
Tamarind and Woodapple ...	25	0	0	Sundries	74	4	9
Maize	24	5	3	Poultry	27	12	0
Brinjals	29	4	9	Sugar-cane Plants	7	14	0
Mango Fruit	20	0	0	Manure	3	0	0
Poultry, &c.	12	6	0	Half-year's Rent	192	8	0
Seed Gram	12	0	0	Rent charge on capital expended on Landlord's Improvements charged at 7½ per cent. as advanced	94	6	7
Plantains	9	10	6				
Vegetables	6	13	3				
Cholum	6	0	0				
Tenney	5	10	0	Interest on Tenant's capital Charged at 5 per cent. as advanced	69	8	4
Total ...	4,218	1	2	Total ...	4,218	1	2

(Signed) W. R. ROBERTSON.

Model Farm Balance Sheet.

	Rs.	A.	P.	Rs.	A.	P.
Liabilities.						
Loan advanced by Experimental Farm as Tenant's Capital ...	2,776	9	10			
Bills due	135	13	2			
				2,912	7	0
Assets.						
18 Working Cattle ... ... Rs. 1,260						
11 Feeding Cattle ... ... „ 164						
	1,424	0	0			
Poultry	18	12	0			
Implements as catalogued	471	9	0			
Manures	75	0	0			
Straw in Yard	100	0	0			
Grain in Granary.						
2,142 lbs. of Varagoo	30	0	0			
2,204 „ of Kar Paddy	29	0	0			
1,443 „ of Chumba Paddy	21	0	0			
269 „ of Shamay	10	0	0			
2,762½ „ of Gram	42	0	0			
963½ „ of Yellow Cholum	15	0	0			
110 „ of Tenney	4	0	0			
188 „ of Ground-nut	5	0	0			
Fruit on Trees.						
Cashew-nut Fruit	30	0	0			
Mango Fruit	57	12	0			
Guava Fruit	30	0	0			
Fruit Trees.						
100 Cocoanut Trees	50	0	0			
63 Mango Trees	35	0	0			
800 Plantain Trees	125	0	0			
Growing Crops.						
Hay Field	60	0	0			
Sugar-cane	39	13	0			
Brinjals	35	0	0			
Cultivation done for next year	55	0	0			
Sundries	10	0	0			
Outstanding Bills.						
Straw	50	0	0			
Carolina Paddy	35	0	0			
Maize	30	0	0			
Cholum	16	0	0			
Poultry	7	8	0			
Sundries	13	6	0			
Dholl	10	0	0			
Vegetables	3	0	0			
				2,937	12	0

(Signed) W. R. ROBERTSON.

Catalogue of Machines and Implements, &c., belonging to the Model Farm, 31st March 1871.

1 Box cart.
2 Country carts.
2 Iron ploughs.
1 Set of harrows with swingle-tree.
2 Combined ploughs.
3 Wheel-barrows.
8 Picottah buckets.
1 Clock.
6 Digging forks.
6 Hoes.
7 Yokes.
1 Table.
9 Feeding tubs.
1 Water cask.

1 Dung fork.
2 Spades.
1 Hand saw.
1 Knife.
1 Hatchet.
1 Hay fork.
Mamooties.
1 Pair pincers.
1 Hammer.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Levelling board with chain.
Sundries belonging to ploughs, &c.

(Signed) W. R. ROBERTSON.

APPENDIX.

Rain-fall, Government Experimental Farm, commencing 1st April 1870, ending 31st March 1871.

April 1870.	May 1870.	June 1870.	July 1870.	August 1870.	September 1870.	October 1870.	November 1870.	December 1870.	January 1871.	February 1871.	March. 1871.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches	Inches.	Inches.	Inches.	Inches.	Inches.
1	1	1	1	1	1	1	1	1 ... ·35	1	1	1 ... ...
2	2	2	2	2	2	2	2	2 ... ·65	2	2	2 ... ...
3	3	3	3	3	3	3	3	3	3	3	3 ... ...
4	4	4	4	4	4	4	4	4	4	4	4 ... ·05
5	5	5	5	5 ... ·24	5	5 ... 3·55	5 ... ·35	5	5	5	5 ... ...
6	6	6	6	6 ... ·42	6 ... ·89	6	6	6	6	6	6 ... ·65
7	7	7	7	7 ... ·21	7	7	7 ... ·15	7	7	7	7 ... ...
8	8	8	8 ... ·21	8 ... 2·95	8	8 ... ·35	8	8	8	8	8 ... ...
9	9	9	9	9	9	9	9	9	9	9	9 ... ...
10	10	10	10 ... ·85	10	10 ... ·80	10	10 ... ·25	10	10	10	10 ... ...
11	11	11	11	11	11	11	11 ... ·55	11	11	11	11 ... ...
12	12	12 ... 4·35	12	12	12 ... 2·30	12	12 ... ·01	12	12	12	12 ... ...
13	13	13 ... 1·05	13	13 ... ·25	13 ... ·20	13	13 ... ·15	13	13	13	13 ... ...
14	14	14 ... ·35	14	14 ... 1·25	14	14 ... ·35	14 ... 1·50	14	14	14	14 ... ...
15	15	15 ... ·95	15	15	15	15 ... ·15	15 ... ·75	15	15	15	15 ... ...
16	16	16	16 ... ·28	16	16 ... 1·60	16	16	16	16	16	16 ... ...
17	17	17	17	17	17 ... ·95	17	17	17	17 ... ·15	17	17 ... ...
18	18	18	18 ... ·45	18	18	18 ... ·65	18 ... ·58	18	18	18	18 ... ...
19	19	19	19 ... 1·10	19	19 ... ·16	19 ... 4·15	19	19	19 ... 1·05	19	19 ... ...
20	20	20	20	20	20	20 ... 4·95	20	20	20	20	20 ... ...
21	21	21	21 ... ·50	21	21	21 ... ·63	21 ... ·15	21	21	21	21 ... ...
22	22	22	22	22	22	22 ... 1·25	22 ... ·35	22	22	22	22 ... ...
23	23	23 ... ·28	23 ... ·42	23	23	23 ... ·35	23 ... ·65	23	23	23	23 ... ...
24	24	24	24	24	24	24 ... ·15	24	24	24	24	24 ... ...
25	25	25	25 ... ·26	25	25	·5 ... ·10	25	25	25	25	25 ... ...
26	26	26	26	26	26	26	26	26	26	26	26 ... ...
27	27	27	27 ... 2·25	27	27	27	27	27	27	27	27 ... ...
28	28	28 ... ·98	28 ... ·51	28 ... ·60	28	28	28	28	28	28 ... ·68	28 ... ...
29	29	29 ... ·28	29	29 ... 1·60	29	29	29	29 ... ·20	29		29 ... ...
30	30	30 ... ·08	30	30	30	30	30	30	30		30 ... ...
	31		31 ... 1·65	31		31		31	31		31 ... ...
Total...None.	Total...None.	Total ...8 32	Total ...8·48	Total ...7·52	Total ...6·90	Total ...16·63	Total ...5·44	Total ...1·20	Total ...1·20	Total ...·68	Total ...·70

(Signed) W. R. ROBERTSON.

SEED ACCOUNT.

SEED RECEIVED.

Month and Date.	From whom received.	Maize.	Cotton	Carolina Paddy.	Yellow Cholum.	Sorghum Saccharatum.
1870.		lbs.	lbs.	lbs.	lbs.	lbs.
April 1st ...	Balance as shown in a Statement detailed in the Appendix to Annual Report, dated April 1st, 1870	2,308	196	11,592	...	...
Sept. 29th ...	From the President, Municipal Commission, Madras	...	...	160	...	...
1871.						
March ...	Received from the Experimental and Model Farms	1,157	...	...	...	...
Do. do. ...	Do. do. do. ...	...	...	2,030	...	...
Do. do. ...	Received from the Experimental Farm	...	...	...	1,500	500
	Total ...	3,465	196	13,782	1,500	500
	Balance in Granary, 1st April 1871.	840	...	1,365	1,088	341

(Signed) W. R. ROBERTSON.

SEED DESPATCHED.

Month and Date.	To whom despatched.	Maize.	Cotton.	Carolina Paddy.	Yellow Cholum.	Sorghum Saccharatum.
1870.		lbs.	lbs.	lbs.	lbs.	lbs.
April 23rd ...	Despatched to the Board of Revenue, Calcutta	...	...	2,670	...	...
Do. 25th ...	To Minchin, Esq., Aska... ...	...	...	130	...	...
Do. do. ...	To Messrs. Arbuthnot and Co., Madras	...	...	130	...	...
Do. do. ...	To the order of J. H. Blair, Esq...	10	...	...	...	...
...	Do. do.	45	...	...	...	...
...	Do. do.	20	...	...	...	...
Do. 26th ...	To the Commissioner of Revenue, Bombay	...	...	890	...	...
Do. do. ...	To the Collector of Canara ...	...	...	390	...	...
Do. do. ...	Do. do. of Malabar ...	...	...	650	...	...
May 6th ...	To the Honourable G. S. Forbes, Adyar	7	...	...	...	...
Do. do. ...	Transferred to Feeding Account...	100	...	...	...	...
Do. 17th ...	To the Collector of Madura ...	130	...	...	...	...
Do. do. ...	To Appa Naick, Chingleput ...	12	...	...	...	...
Do. do. ...	To the Collector of Vizagapatam..	...	...	130	...	...
Do. 20th ...	To the order of J. H. Blair, Esq....	...	...	20	...	...
Do. do. ...	To the Collector of Madura ...	...	...	360	...	...
Do. do. ...	Do. do.	...	...	360	...	...
Do. do. ...	To Appa Naick, Chingleput ...	...	...	10	...	...
Do. 23rd ...	To Lieut.-Colonel C. H. Drury, Nungumbaukum	10	...	...	...	...
Do. 24th ...	To the Collector of Bellary ...	...	...	130	...	...
Do. do. ...	Do. do. of Godavery ...	...	...	260	...	...
Do. do. ...	To the Munsiff of Erode	...	...	130	...	...
Do. do. ...	To the Collector of Tinnevelly ...	...	...	45	...	...
Do. do. ...	Do. do. of North Arcot...	...	...	390	...	...
Do. do. ...	Do. do. of Trichinopoly...	...	...	260	...	...
June 2nd ...	To the Mahants of Triputty ...	...	...	45	...	...
Do. 3rd ...	To the Rajah of Kalastry ...	20	...	...	...	...
Do. 4th ...	To the Collector of North Arcot...	10	...	50	...	...

SEED DESPATCHED.—(*Continued.*)

Month and Date.	To whom despatched.	Maize.	Cotton.	Carolina Paddy.	Yellow Cholum.	Sorghum Saccharatum.
1870.		lbs.	lbs.	lbs.	lbs.	lbs.
June 6th ...	To Jogeenachu Ramayah Naidu, Asst. Supt. of Mysore	...	...	45	...	...
Do. 7th ...	To the Collector of North Arcot...	130	...	260	...	...
Do. do. ...	To William Kerr, Esq., Bombay...	50	...	...	...	...
Do. do. ...	To the Collector of the Kistna District	...	...	130	...	...
Do. 11th ...	To G. S. Morris, Esq., Collector of Tanjore	...	...	25	...	...
Do. do. ...	To H. E. Sullivan, Esq., Collector of Coimbatore	...	...	1,690	...	...
Do. do. ...	To P. L. Roberts, Esq., Sub-Collector of South Arcot	...	...	130	...	...
Do. do. ...	To H. Grimes, Esq., Supt., Central Jail, Coimbatore	50	...	...	...	...
Do. 13th ...	To W. T. Blair, Esq., Collector of Madras	...	...	650	...	...
Do. 15th ...	To Trimul Row Saib, Jagirdar of Arnee	30	...	20	...	...
Do. do. ...	To Sheristadar of Revenue Board.	...	...	40	...	...
Do. 16th ...	To Colonel Greenlaw, Madras ...	4	...	...	...	...
Do. 20th ...	Do. do.	10	...	...	...	...
Do. do. ...	To the Right Hon'ble Lord Mayo.	25	...	...	...	...
Do. do. ...	To the Honorary Secretary, Agri-Horticultural Society, Calcutta...	15	...	...	...	...
Do. do. ...	To Ashburner, Esq., Collector of Dhonbie Kandish	25	...	...	...	...
Do. 25th ...	To the Superintendent of Central Jail, Rajahmundry	20	...	...	...	...
Do. do. ...	To Capt. J. C. Hay, Trivandrum..	2	...	...	...	...
July 25th ...	To the Honorary Secretary, Agri-Horticultural Society, Calcutta..	...	...	...	15	...
Do. do. ...	To the Right Hon'ble Lord Mayo, Calcutta...	...	...	...	25	...
Do. do. ...	To Narayana Bhiragi, Nagpore...	...	...	...	10	...
Do. do. ...	To Ashburner, Esq., Collector, Dhonbie Kandish, Bombay ...	...	...	...	150	...
Do. do. ...	To J. N. Grainger, Esq., Madras...	...	...	...	15	...
Do. 30th ...	To Donald Stewart, Esq.... ...	...	...	...	5	...
August 2nd ...	Transferred to Feeding Account...	...	...	950	...	...
Do. 5th ...	To Ritchi, Esq.	10	...	...	10	...
Do. do. ...	To A. Peter, Esq....	10	...	...	10	...
Do. do. ...	To Donald Stewart, Esq.... ...	5	...	...	...	...
Do. 16th ...	To the Jagirdar of Arnee ...	20	...	...	16	...
Do. 18th ...	To the Collector of Canara ...	...	...	...	40	...
Do. do. ...	To Colonel Ewart	2½	...	...	...	...
Do. do. ...	To Ramasawmy Naick, Chittoor...	2	2	...	6	...
Sept. 17th ...	To Minchin, Esq....	...	...	...	5	...
Do. do. ...	To Captain Beauchamp, Trichinopoly	...	...	...	5	...
Do. 28th ...	Transferred to Feeding Account...	...	194	264	...	...
Nov. 21st ...	To W. T. Blair, Esq., Madras ...	5	...	...	...	...
Do. 29th ...	To Dr. Pritchard	2½	...	...	...	...
1871.						
Feb. 2nd ...	To the President of Municipal Commission, Madras	...	...	160	...	...
Do. 17th ...	To Calcutta	6	...	3	...	3
Do. 20th ...	To A. H. Gordon, Esq.	20	...	...	...	...
Do. 25th ...	To W. A. Kerr, Esq., Bombay ...	...	...	...	...	25
Do. do. ...	To the Superintendent of Coimbatore Jail, Coimbatore ...	10	...	...	...	10
Do. do. ...	To the Superintendent of Salem Jail, Salem	30	...	...	...	10
Do. do. ...	To W. Bowden, Esq,, Poonamallee.	30	...	...	...	6
Do. do. ...	To the Honorary Secretary, Horticultural Society, Bangalore ...	15	...	...	...	5

SEED DESPATCHED.—(*Concluded.*)

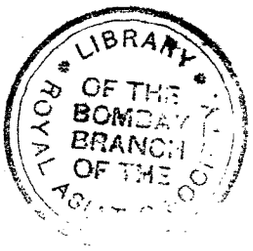
Month and Date.	To whom despatched.	Maize.	Cotton.	Carolina Paddy.	Yellow Cholum.	Sorghum Saccharatum.
1871.		lbs.	lbs.	lbs.	lbs.	lbs.
March 23rd ...	To the Cotton Commissioner, Central Provinces	165	...	...	...	10
Do. do. ...	To J. Munro, Esq., Cochin ...	150	...	...	100	50
Do. do. ...	To James Hunter, Esq., Coonoor..	40	...	...	...	10
Do. do. ...	To Dr. Hunter, Madras	40	...	...	...	10
Do. do. ...	To Dr. Cornish, Madras	20	...	...	...	10
Do. do. ...	To T. Pritchard, Esq., Madras ...	30	...	...	...	10
Do. do. ...	To the Commissioner of Oude ...	...	...	1,000	...	...
July 30th ...	Transferred to Cattle Food Account	1,287	...	...	...	...
	Stock in Granary, 1st April 1871.	840	...	1,365	1,088	341
	Total ...	3,465	196	13,782	1,500	500

(Signed) W. R. ROBERTSON.

THE

MADRAS EXPERIMENTAL

AND



MODEL FARMS' REPORTS,

FOR THE YEAR ENDING 31ST OF MARCH 1872.

MADRAS:
PRINTED BY H. MORGAN, AT THE GOVERNMENT GAZETTE PRESS.

1873.

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APPENDIX.

1. Rainfall of the year.
2. Valuation of Live and Dead Stock belonging to the Experimental Farm.
3. Distribution of Seeds.
4. Implements, Carts, Machines, &c., belonging to the Experimental Farm.
5. Do. do. do. to the Model Farm.
6. Do. do. do. to the Implement Works.
7. Catalogue of Books in the Library.

THE MADRAS EXPERIMENTAL AND MODEL FARMS' REPORTS FOR THE YEAR ENDING 31ST OF MARCH 1872.

GENERAL.

1. *Season.*—The weather experienced during the past year was very unfavorable for dry cultivation, though for wet cultivation more favorable weather could scarcely have been desired. The total rainfall of the year was 52·47 inches, or about 7½ inches above the average annual fall of the previous 10 years. The character of the past season illustrates very forcibly what, in former reports, I have so frequently drawn attention to, viz., that, when the total rainfall of a year is in *excess* of the average annual fall, it does not necessarily follow that the year was a *favorable* one for dry land cultivation, and this is very apparent when we begin to analyze the past year's registrations; thus, though the total fall was *much above* the average annual rainfall, yet *there was a dearth of rain during the time when it really was wanted.* In the 17 weeks, between the 1st of December and 31st of March (the growing season in this district), the total fall *was only one inch,* the average fall for the same period for the previous 10 years *being* 7¼ *inches;* while in the six weeks before the 1st of December rain fell during 20 days, giving a total fall of 32·34 inches. This *heavy* fall, though valuable to the wet land farmer in filling his tanks, &c., was almost as much *waste* to the dry land cultivator, for not only did the greater portion flow off the land, carrying away with it soil and valuable fertilizing matters, but a very considerable amount of *direct* damage was done to growing crops; and during the heavy rains the growth of the crops was so unnaturally forced, *they only suffered the more* in the long drought which followed. Many experiments, especially those made with the view of ascertaining the value of different saline manures, were rendered useless. The cropping experiments were only a *little* more successful, as, owing to the long drought after the heavy rains, the crops ripened before they were properly matured; thus, the maize crop, which is generally not harvested until the end of January or the beginning of February, was last season gathered in December. For *dry* land cultivation, a moderate rainfall is required, distributed pretty evenly over the cultivating season; instead of this, during the past year, 50 *per cent. of the total fall fell during three weeks* in November. The daily registrations of last year's rainfall are published in the Appendix.

2. *Dissolution of the Farm Committee.*—The Farm Committee was dissolved in October last, when the general supervision of all attempts to improve the agricultural practice of this Presidency through the agency of Government Farms was transferred to the Board of revenue, the direct management of the Madras Farms being placed in my hands with the general management of all similar farms that may hereafter be established by Government in this Presidency.

3. *Tours.*—The only tour undertaken during the past year was one over the Neilgherry District, made in compliance with Government Order, No. 1,658, dated 22nd of September 1871. I left Madras on the 16th January, and returned again on the 27th March. On my return journey I availed myself of the opportunity, when at Coimbatore, to inspect the site for an Experimental Farm in that district; the result of that inspection I have already communicated to the Board.

4. *Office Work.*—During the past year my office work was very considerably increased. To some extent, this may be accounted for by the change referred to in paragraph 2, but by far the greatest proportion of the increase can be traced directly to the effect of

the greater public attention these reports now receive, the increase being chiefly in correspondence, thus—

Letters written, 1870-71.	Honorary Secretary's Office ...	109	491
	Superintendent's Office	382	
Letters written, 1871-72.	Honorary Secretary's Office ...	23	773
	Superintendent's Office	750	

this is exclusive of demi-official correspondence, which has increased almost as greatly. Many of these letters were addressed to persons resident in Mysore, Central India, Bombay, Bengal, the Andamans, and Ceylon. Nearly every branch of agriculture has been discussed in these letters, and, I trust, that my correspondents and myself have been mutually benefited. This large correspondence necessarily taxes my time very heavily, still, I think, it is very undesirable that it should be curtailed in any way. In the absence of local agricultural newspapers, farmers' clubs, &c., correspondence is the only means we possess, whereby we can collect facts and observations from those competent to afford such information, who are so *few* in number, and are scattered at such wide intervals over the country. It is, I think, to be regretted that we have in this country nothing corresponding to the volume published annually by the American Agricultural Department, in which a portion of such correspondence might find a place. It seems very desirable that something should be done in this direction, as there is *much* valuable information scattered over the country now lying in a dormant state, which might easily be collected and turned to good account. Our great Agricultural Societies in Europe fully recognize the importance of utilizing the observations of those actually engaged in agricultural pursuits and of those who take an interest in agriculture, and, by giving prizes for reports and essays on agricultural subjects, collect a large amount of most valuable information. Such information, founded on actual experience under all sorts of circumstances, is very valuable. It affords material, out of which data can be obtained for the guidance of the farmer under any given set of circumstances.

5. *Estate Improvements.*—A piece of land situated in the centre of the Experimental Farm, which was formerly waste, not being capable of cultivation on account of the heaps of brickyard refuse and large worked-out clay holes, was levelled and brought under cultivation, and will, I think, form one of the most valuable fields on the farm. A considerable area of land covered with jungle scrub on the south and south-east of the homestead on the Experimental Farm was cleared and levelled, and the most sandy portions were heavily dressed with alluvial silt. The bulk of this land can be readily watered from the river Adyar, the average level of the river being only about three feet below its surface. The old building, which stood in the centre of the road near the western approach gate, has been removed, and the road has been straightened. Drains have been cut in various parts of the estate for carrying off storm water, from which during the monsoon we used to suffer severely, partly from the wash, and partly from flooding. An upper story was added to the Superintendent's house, and a house for the Overseer of the Experimental Farm was erected near the farm buildings. Nearly all the palmyra bridges over the drains and water channels have been removed, and have been replaced by well-built stone bridges. A slaughter-house and an additional poultry-house were erected at the Model Farm, while the buildings, roads, and fences on the estate were put in good repair.

THE EXPERIMENTAL FARM.

6. *Cattle.*—I have not yet been able to reduce the number of draught cattle kept at this farm, as so much carting had to be performed in connexion with estate improvements; indeed, not more than two-thirds of the labor of our working cattle on this farm is devoted to actual farm work. The buffalo bulls, referred to in my last report, continue to work steadily. They are most useful animals either for carting or ploughing: for *deep* ploughing they are admirably suited, on account of their enormous strength and steady action. There is, I find, a very general impression that buffaloes will *not* work during the

heat of the day; but we have never experienced any more trouble with them than with ordinary plough cattle, while their keep is decidedly *much less* costly than the keep of ordinary cattle, as they will eat any sort of coarse fodder, and they are very hardy.

7. The experiments made last year in feeding cattle on ground-nut oil cake were so satisfactory, and the price of gram having risen so much I have for some time ceased using gram in feeding our stock, and have used ground-nut cake instead. The result of the change has been *all* that I could desire. The animals have thriven as well, indeed, I think, better than they formerly did when fed on gram. A richer manure is made, and the cost of feeding is only about one-*half* the amount it would have been, had we continued to use gram, thus—

	Rs.	A.	P.
Excluding fodder, the 22½ pairs of working cattle employed on the two Madras Farms would, if fed under the old system, at the present price of gram cost monthly	140	0	0
The same cattle fed on cake under the new system, at the present price of cake cost monthly	60	0	0
Leaving a difference per month amounting to	80	0	0

Thus, a *very sipmle* experiment has enabled us to effect a saving of nearly 1,000 *rupees per annum* in the cost of feeding our draught cattle. We allow four pounds of cake per head daily, instead of the four pounds of gram formerly given. The cake is always steeped before being distributed to the cattle. This ground-nut cake is a most valuable food for *all* kinds of stock. The following is an analysis of an average sample by Doctor Voelcker, F.R.S., &c. :—

	Per cent.
Moisture	10·80
Oil	8·12
(*a*) Albuminous or flesh-forming compounds	28·62
Mucilage, gum, &c.	18·86
Cellular fibre	29·09
(*b*) Ash	4·51
Total ...	100·00
(*a*) Containing nitrogen	4·50
(*b*) Containing sand	1·40

For comparison I place on record here an analysis of an average sample of linseed cake by the same authority :—

	Per cent.
Moisture	10·67
Oil	12·87
(*a*) Albuminous or flesh-forming compounds	28·12
Mucilage, gum, &c.	27·01
Cellular fibre...	14·11
(*b*) Ash	7·22
Total ...	100·00
(*a*) Containing nitrogen	4·30
(*b*) Containing sand	1·18

It will be seen that the ground-nut cake is *very little* inferior to linseed cake, which is sold at from £12 to £13 per ton for feeding purposes at home. When I first commenced feeding with ground-nut cake, I experienced great difficulty in obtaining a *regular* supply; but I have now succeeded in meeting with a contractor who supplies me regularly

with 10,000 pounds a month, at Rupees 5-8-0 per candy (of 500 pounds) delivered in Madras, or at about 25 rupees per ton delivered at Sydapet, and I fancy there would at the proper season be no difficulty in making a contract for a supply ten times as great, as, when the contract was let, there were several disappointed offerers, and a large quantity is annually exported.

8. As a food for horses, this cake is *extremely* valuable. I have now used it for upwards of two years in my own stable with the most gratifying results. It is only necessary to remember that, *weight for weight,* it is as *nutritious* as gram, and that, in most seasons, *it can be purchased at half the price of gram;* to ascertain at once the saving that would be effected by substituting cake for gram, however, I do not recommend that in feeding horses this should be done. It is, I think, for such a purpose a better plan to deduct one-half the usual allowance of gram, and to replace this by cake. In this way a saving of 25 *per cent.* could be effected in the cost of the food of every horse now fed on gram, while the condition of the animal would be improved. A Pegu pony, which formerly received daily 2½ measures of gram (measured before being cooked) and was never in good condition, has been for the past 18 months fed on the following daily allowance:—

1 measure (measured before cooking) of gram,
2 pounds of ground-nut cake,

and is now in excellent condition. Under the old method of feeding, his gram at the present price would cost monthly Rupees 5-14-2; the food he now gets only costs Rupees 3-1-8 per mensem.

9. As long as we used gram in feeding our cattle, it was invariably prepared by *steeping* only, and this method of preparing it is certainly much the best. Some have supposed that gram is less nutritious, as well as less palatable, after being steeped than after being boiled, but this is a mistake, for quite independent of the fact that boiling renders the albumen of the gram insoluble and, therefore, less digestable, the cells of the pulse are generally violently ruptured during the boiling process, and a large quantity of soluble nutritious matters are set free. These are lost in the water, and go to form the soup, which the horse-keeper generally appropriates. The substitution of steeping for boiling in the preparation of gram as food for horses will not, I think, become so general as was anticipated. Since my last report was written, steeped gram has been tried in many stables, and the results have not generally been satisfactory. Some horses eat it readily, but others altogether refuse it. As a general rule, I have found that recently imported horses eat it better than horses which for years have been fed on boiled gram; and, as most of the horses in this part of India are imported from countries in which this pulse is unknown, it would, on their first arrival, be as easy to accustom them to steeped as to boiled gram.

10. Owing to the prevalence of cattle disease in the neighbourhood, and the difficulty of finding a market for fat cattle, very few cattle were fattened on the Experimental Farm; and I see little prospect of doing much in this direction, until we possess regular fairs and markets in Madras, and have a class of middlemen to take the place of the "dealer" and "butcher" of European countries. At present there are no *regular* fairs in Madras. When we have cattle or sheep to sell, we do not know where to find a purchaser, and when we want to buy cattle or sheep, we do not know where to find a seller, *though there may be numbers of persons in the district who would readily buy what we have to sell, or who would gladly sell what we may want to purchase.* By advertising something can be done; but this is obviously a very imperfect way of bringing together sellers and purchasers of live stock. There are certainly one or two places on the outskirts of the city in which cattle are occasionally exposed for sale, but the animals offered are generally of the most wretched description, and, such as they are, cannot be purchased by an *occasional* buyer, *until the Commissariat meat contractor has made his purchases.* I have visited these places several times, and, each time have been refused the offer of cattle for the reason just given. Surely, Madras with its weekly consumption of something like 500 head of cattle and 20,000 sheep should be provided with live stock markets. Such markets would be a source of income to the municipality, would be a great convenience to farmers, and would be a great

advantage to the general public. *The sale of diseased animals would be rendered more difficult,* and the competition started would result in a better and more carefully prepared class of animals being offered for sale.

11. But besides live stock markets we need meat markets and meat salesmen. When we have fat stock to sell, we cannot obtain a fair price. The country butchers will not give a reasonable price for *fed* stock: they can make much larger profits by buying for slaughter diseased cattle, old cows, and worn out bullocks. Such animals can be bought at from 8 to 10 rupees per head, and will, when the meat is sold at 2½ annas per pound, leave a profit of from 10 to 12 rupees—*a sum they would not get on a fat bullock, for which they might pay* 30 *rupees.* If the wretched animals, the country butchers now buy, will return them at least 100 per cent. profit, it is scarcely to be wondered at that they will not pay 30 rupees for a fat bullock on which they could not hope to get more than a profit of 10 rupees, or about 30 per cent., even could they *always* command the cash with which to buy such animals. If a respectable class of meat salesmen existed, who would be content with returns of from 20 to 25 per cent. in excess of the cost for killing and distributing the meat, the public could be supplied with first-class beef at four annas per pound, and the farmer would be well repaid for fattening the animals.

12. The only way in which we can turn our fat stock into money is by killing the animals and distributing the meat at the farms. The results are *most* unsatisfactory. We are at a considerable expense in circulating "requirement sheets." Often from 20 to 50 per cent. of the meat was not engaged on the day fixed for distribution, and was sold amongst the farm coolies at one quarter of its value. It is generally inconvenient to purchasers to send their servants to the farm for the meat, especially as the market from which other supplies are obtained is situated in quite a different direction, and last, but not least, the hostility of servants to the arrangements under which meat is sold at the farms (fixed prices and areceipts invariably given) is *universal.* All sorts of hinderances are put in the way of the free circulation of the "sale lists," while no opportunity is lost to disparage the quality of the meat; and it is not difficult to suppose that the *opportunity* the cook enjoys admits of confirmatory evidence of a most conclusive character being readily produced. Again, meat sale lists in the form used by our farms are, I believe, in frequent circulation in this district. I have seen one in every way similar, excepting that the heading was "*farm* fed beef," instead of "*Government* Farm beef," and the usual signatures were omitted. Some who have obtained agricultural produce, whether meat, poultry, or grain, by signing these lists, have expressed their disappointment with Government Farm produce, without putting themselves to the trouble to ascertain whether the produce supplied to them really was obtained from a *Government* Farm. Instances of this sort are frequent. I have done what I can to prevent their recurrence, by insisting that the Overseers shall in *every* instance give a receipt in a printed form for all money they receive, but it is evident that the remedy is chiefly in the hands of the purchaser.

13. If farmers are prepared to supply fat cattle that will yield *good* beef at *three annas per pound,* nothing more can be fairly expected of us. *We cannot supply the consumer.* It is no part of *our* duty either to kill or to distribute meat. If consumers cannot make their own arrangements to obtain properly fed beef on *reasonable* terms, they only have themselves to blame. Let good markets be provided, and let respectable retail meat salesmen be properly encouraged, and farmers will find it worth while to fatten cattle for slaughter. At present there is *no inducement,* though the prices now paid by consumers of the better qualities of meat would *fully recompense* the feeder, and leave a fair profit to the retailer, still the expense and the difficulties now encountered in the endeavour to reach the consumers are such, that there is nothing to encourage an attempt to better matters; while the consumer, who might obtain healthy well-fed meat by retail at from 4½ pence to six pence per pound, has no alternative but to use the wretched stuff now provided for his use, and this, in a country where cattle are frequently the village scavengers, and in which cattle disease, in its various forms, is *always* at work.

14. I am glad to be able to place on record the general results of a number of experiments made to test the milk and butter producing qualities of an *ordinary* Nellore cow,

The experiments were conducted under the personal direction of a lady, who very kindly undertook the duty. The information collected is most valuable, as the whole of the results were obtained under *personal* inspection, every care being taken to ensure perfect accuracy. Such experiments *cannot* be conducted on our farms, excepting at a *considerable* cost in providing lock-up houses and in employing trustworthy men *specially* for the work; and even with every care I doubt whether the results obtained would be altogether reliable, as the work demands the scientific nicety of the laboratory. The cow, which is an old one, was purchased for 60 rupees. At the time of purchase she had a calf about one month old. She was much out of condition. Her live weight, ten days after she was bought, was only 536 pounds. Her food is daily—

4 pounds of ground-nut cake.
2 pounds of wheat bran.
20 pounds of green fodder (cholum, &c.)
15 pounds of grass.
¾ ounce of salt.

She is allowed to graze in a compound each morning, after being milked, for about a couple of hours; during the remainder of the day and during night she is tied in a byre, and is always abundantly supplied with drinking water. She is milked at about seven in the morning, and at about five in the evening. She eats her cake (steeped) and bran while she is being milked, and her calf is allowed to be near her at the time, being permitted to strip any milk left. After this is done the calf is not allowed to go near its dam, until the milking hour again comes round. The following details show the quantity of milk obtained at each milking during the 12 weeks over which the experiment extended :—

—	Morning.		Evening.		Total.		—	—	Morning.		Evening.		Total.		—
	Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks.	Pints.		Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks.	Pints.
1st day ...	1	2	1	3	2	5		29th day...	1	5½	1	2½	3	0	
2nd „ ...	1	4	1	2	2	6		30th „ ...	1	5½	1	3	3	0½	
3rd „ ...	1	4	1	1	2	5		31st „ ...	1	5½	1	3½	3	1	
4th „ ...	1	2	1	1	2	3		32nd „ ...	1	6	1	3	3	1	
5th „ ...	1	4	1	2	2	6		33rd „ ...	1	7	1	6½	3	5½	
6th „ ...	1	5	1	2	2	7		34th „ ...	2	1	1	5	3	6	
7th „ ...	1	5	1	2	2	7		35th „ ...	2	1	1	6	3	7	
1st Week...	10	2	8	5	18	7	57¾	5th Week..	12	7½	10	5½	23	5	72
8th day ...	1	4	1	2	2	6		36th day...	1	7	1	5	3	4	
9th „ ...	1	5	1	3	2	8		37th „ ...	2	2	1	6	4	0	
10th „ ...	1	6	1	4	3	2		38th „ ...	2	1	1	6	3	7	
11th „ ...	1	7	1	4	3	3		39th „ ...	2	1	1	5	3	6	
12th „ ...	1	5	1	4	3	1		40th „ ...	2	1	1	5	3	6	
13th „ ...	1	6	1	5	3	3		41st „ ...	2	1	1	6	3	7	
14th „ ...	1	6½	1	6	3	4½		42nd „ ...	2	2	1	6	4	0	
2nd Week...	11	7½	10	4	22	3½	68⅓	6th Week..	14	7	11	7	26	6	81¾
15th day...	1	6	1	3	3	1		43rd day...	2	0	1	6	3	6	
16th „ ...	1	7	1	4	3	3		44th „ ...	2	1	1	5	3	6	
17th „ ...	1	7	1	4	3	3		45th „ ...	2	1	1	6	3	7	
18th „ ...	1	5	1	5	3	2		46th „ ...	2	1½	1	6½	4	0	
19th „ ...	1	5	1	4	3	1		47th „ ...	2	2	1	6	4	0	
20th „ ...	1	7	1	4	3	3		48th „ ...	2	1	1	5	3	6	
21st „ ...	1	5½	1	5	3	2½		49th „ ...	2	1½	1	5	3	6½	
3rd Week...	12	2½	10	5	22	7½	70	7th Week..	15	0	11	7½	26	7½	82
22nd day...	1	4	1	4	3	0		50th day...	2	2	1	6	4	0	
23rd „ ...	1	6½	1	4	3	2½		51st „ ...	2	0	1	6	3	6	
24th „ ...	1	5½	1	4	3	1½		52nd „ ...	2	3	1	6	4	1	
25th „ ...	1	7	1	4	3	3		53rd „ ...	2	1	1	4	3	5	
26th „ ...	1	6½	1	2½	3	1		54th „ ...	2	0	1	5	3	5	
27th „ ...	1	5½	1	4	3	1½		55th „ ...	2	1	1	3	3	4	
28th „ ...	1	3½	1	3	2	6½		56th „ ...	2	2½	1	4	3	6½	
4th Week...	11	6½	10	1½	22	0	67	8th Week..	15	1½	11	2	26	3½	80¾

——	Morning.		Evening.		Total.		—	——	Morning.		Evening.		Total.		—
	Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks.	Pints.		Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks	Pints.
57th day...	2	1	1	5	3	6		71st day...	2	2	1	5	3	7	
58th „ ...	2	3	1	4	3	7		72nd „ ...	2	2	1	6	4	0	
59th „ ...	1	7	1	4	3	3		73rd „ ...	2	2	1	6	4	0	
60th „ ...	2	2	1	4	3	6		74th „ ...	2	2	1	5	3	7	
61st „ ...	1	7	1	4	3	3		75th „ ...	2	2	1	6	4	0	
62nd „ ...	2	0	1	4	3	4		76th „ ...	2	1	1	6	3	7	
63rd „ ...	2	2	1	4	3	6		77th „ ...	2	1	1	5	3	6	
9th Week...	14	6	10	5	25	3	77½	11th Week.	15	4	11	7	27	3	83½
64th day...	2	0	1	5	3	5		78th day...	2	0	1	5	3	5	
65th „ ...	2	2	1	4	3	6		79th „ ...	2	2	1	4	3	6	
66th „ ...	2	2	1	5	3	7		80th „ ...	2	0	1	6	3	6	
67th „ ...	2	2	1	4	3	6		81st „ ...	2	2	1	5	3	7	
68th „ ...	2	1	1	6	3	7		82nd „ ...	2	1	1	6	3	7	
69th „ ...	2	2	1	6	4	0		83rd „ ...	2	1	1	5	3	6	
70th „ ...	2	2	1	6	4	0		84th „ ...	2	1	1	6	3	7	
10th Week.	15	3	11	4	26	7	82	12th Week.	14	7	11	5	26	4	81

At the present time the yield per week is 29 measures. The following are the registrations for the past week :—

——	Morning.		Evening.		Total.		——
	Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks.	Pints.
1st day	2	3	1	6	4	1	
2nd „	2	3	1	6	4	1	
3rd „	2	3	1	6	4	1	
4th „	2	3	1	6	4	1	
5th „	2	2½	1	6½	4	1	
6th „	2	3	1	6	4	1	
7th „	2	3½	1	7	4	2½	
Total ...	16	5	12	3½	29	0½	88¾

While the yield of milk has increased, so also has the weight of the cow; when purchased, about four months ago, she weighed only 536 pounds, she now weighs 679 pounds. The following are a few of the many experiments made in butter-making :—

1. (*a*) A measure of milk, which had been set aside from the previous night's meal, was churned. When churning commenced, the temperature of the milk was 81 degrees. The butter was a long time in appearing, and was collected with great difficulty. The total yield of butter was only three-quarter of an ounce. The milk in this instance underwent no preparation before being churned. It was slightly soured, but this was caused by natural agencies.

   (*b*) Another experiment of the same kind (excepting that, in this instance, the milk was artificially heated to 110 degrees just after leaving the cow) was made with two measures of milk, and the total yield of butter was only 1¼ ounces.

2. A measure of milk, fresh from the cow, was placed in the churn, its natural temperature at the time being nearly 100 degrees. Cold water was added, and the temperature fell to 85 degrees. After churning upwards of half an hour, the butter at length appeared, but the total yield was only half an ounce.

3. (*a*) A measure of milk, immediately after it left the cow, was artificially heated to 110 degrees. About one fluid ounce of churn milk from previous churning was then added, and the whole was placed aside in an ordinary milk bowl. It was churned next morning, being at starting 84 degrees. The butter was a very long time in appearing, nearly a full hour, and the total yield was only 1¼ ounces. The quantity of churn milk used was evidently *far in excess* of the requirement. The milk had

assumed such a coagulated condition, that it was exceedingly difficult to separate the butter from the curd.

(*b*) The experiment was again made with two measures of milk, but less of the churn milk was used. The butter appeared in much less time, and the total weight obtained was four ounces.

(*c*) The experiment was again performed with the same quantity of milk, but still less of the churn milk was used. The butter came within 20 minutes, and the yield was 4½ ounces.

(*d*) The experiment was repeated with the same quantity of fresh milk several times, with varying quantities of churn milk, until, with from six to ten drops per measure, five ounces of butter *were regularly* obtained, generally within 15 minutes from the time of commencing to churn. In very hot weather the less quantity of churn milk was found to be enough, and in cold weather (when the temperature of the milk was less than 70 degrees) one fluid ounce per measure was not too much.

For comparison with the results of the last experiment, a measure of ordinary milk, as supplied by native dairyman, treated in exactly a similar way, was churned for half an hour, but no butter appeared. It was then put aside for an hour, and churned again for 20 minutes, but still no butter came. The milk was tested by an ingenious lactometre made in Madras, and was found to be, by its standard, only two-thirds pure milk. Useful though this little instrument is in ascertaining whether the quality of a *milk reaches a certain standard,* it is not a trustworthy guide as a means of ascertaining the quantity of water *fraudulently* added to a sample of milk, if the quantity added *is less than 20 per cent. of its volume.* Samples of pure milk contain water in various proportions from 80 to 90 per cent., and it is almost as easy for the dairyman to water the milk *before* it leaves the cow, as *afterwards,* by giving the animal succulent watery food, and, in this case, the milk would be none the less *pure.* It may not be out of place to remark here that the adulteration of milk with water (if the water is good) is, after all, only a minor evil. The loss is only in the pocket. It is a far more serious matter if the milk has been obtained from a cow suffering from disease, or if the water the cow drinks, or that is added to the milk, contain minute forms of organized life. Though the ill-effect of drinking the milk of a cow suffering from disease is not always apparent, especially in the case of adults, there are many well authenticated cases in which disease and death can be traced directly to the ill-effects of drinking diseased milk, chiefly amongst children, who are the largest consumers of milk in its unprepared state. Recent investigations of the microscope have revealed the fact that, if a cow is allowed to drink impure water (and few dairy cows drink anything else in this part of India) containing animalcule, the same animalcule will be found in its milk. It has recently been suggested that officers should be appointed to inspect the milk supplied to consumers in Madras, but mere inspection of the milk would be useless. *The only effective way would be to inspect the dairy cattle and dairies,* and *to allow no milk to be sold for consumption except by licensed dairymen.*

15. The practice now followed in butter-making, founded on the foregoing experiments, is as follows:—Strain the milk (morning's meal) immediately it is brought from the cow; measure it; put the quantity needed for butter in a tin can; place this over boiling water in an open chatty resting on a charcoal fire; remove when the temperature of the milk has reached 120 degrees; empty the milk into a milk bowl, and before it cools add from six drops to one fluid ounce of churn milk per measure, as the weather is hot or cold; then place the milk aside in as cool a place as can be provided (though a *hot* dry place is greatly preferable to a cool damp place). The milk obtained at the evening milking is treated in a similar manner, excepting that a few additional drops of churn milk are added. Next morning both lots of milk are put together in the churn (a small tin atmospheric churn). If the temperature of the milk is over 80 degrees, cold water is added to it; but care must be exercised not to fill the churn more than two-thirds full. To keep down the temperature of the milk (which will rise during churning) the churn is placed in a chatty of cold water, and churning is commenced by raising and depressing the plunger—for the first five minutes, at about 50 strokes per

minute; for the second five minutes, at about 80 per minute; and, when the butter begins to come, at about 120 per minute. Butter generally begins to appear in 12 to 15 minutes after commencing to churn. It is not removed until a moderate quantity has accumulated. Churning is continued for about five minutes after the first butter is removed, when a second supply is taken out, and the churning is again resumed for about five minutes longer, or until all the butter is finally obtained, the whole operation of churning generally lasting from 20 to 30 minutes. Great nicety is required in removing the butter, and, in manipulating it afterwards, a degree of cleanliness is demanded that one shudders to think of the preparation butter must undergo at the hands of the ordinary dairyman. After removal from the churn, it is thoroughly washed with cool filtered water, and, during the operation, worked with a bamboo paddle. To facilitate the washing operation, cold water is placed in a goglet fixed over the vessel containing the butter. The bottom of the goglet is perforated with holes of sufficient size to allow a gentle flow of water to pass over the butter. The washings pass over the sides of the bowl, and are collected in a vessel beneath. This operation, when carefully performed, need not occupy more than 10 minutes. The butter so made is as good as any I ever tasted. The flavor of the essential oils is most effectually preserved. When ice is used butter-making is, of course, much less tedious.

16. The general results of these experiments are most satisfactory. In the space of four months 143 pounds have been added to the live weight of the cow, while the yield of milk has been doubled. 120 measures of most excellent milk is now obtained monthly, at a cost, for food and attendance, of Rupees 9-2-11, or at about $1\frac{1}{6}$ annas per measure. The cow is in no way more than an ordinary one. She is old, and was bought from a milkman, who was very unlikely to sell her for 60 rupees had she been more than a *very ordinary* cow; indeed, when offering her for sale, all he could say for her milk-producing abilities was that she would give daily about two measures, and she had been for *some time* in his possession. Under these circumstances, I think I am fully justified in concluding that *the increase of* 50 *per cent.* in the yield of milk *is entirely due to the feeding.* The milk is unusually rich; it yields regularly $12\frac{1}{2}$ per cent. by volume of excellent cream, and the yield of butter confirms this, as from two measures (6·63 pints) of fresh milk, five ounces of butter is now regularly obtained. This is equal to a yield of one pound of butter for 21·2 pints of milk. In England the average quantity of milk required to yield one pound of butter is 22 pints. The milk of the Alderney, the Kerry, and of some of the other small breeds of dairy cattle is much richer than this, though of their milk seldom less than 17 pints are required to yield one pound of butter; indeed, I only know of one published instance in which a less quantity yielded one pound, and that was in a dairy of Kerrys grazed on the rich ever-green pastures of the south-west of Ireland; in that instance, 16 pints of milk regularly yielded one pound of butter.

17. I have dwelt at this length on these dairying experiments, as I am not aware that any of the sort have been previously made in this country, and dairying is a branch of agriculture, the importance of which cannot be over-rated.

Sheep.

18. *Sheep.*—The breeding experiment continues to yield most satisfactory results. There is a very marked improvement in each season's lambs, though it will, of course, take years to establish anything like uniformity in the flock; but the results already obtained are most encouraging. We have produced two year old sheep, weighing from 110 to 120 pounds live weight, capable of yielding 50 lbs. of mutton, worth (at Annas 4 per lb.) $12\frac{1}{2}$ rupees; and these are from a flock of country ewes, many of which, at the time the experiment commenced, would not have realized 2 rupees each in the market. Indeed, I sold nearly 100, at prices ranging between $1\frac{1}{4}$ rupees and 2 rupees per head, and experienced some difficulty in getting even these prices.

19. Unfortunately, we cannot afford to dispose of our Sydapet sheep to the butcher. They are much too valuable at present for killing. The only sheep we kill are old or barren ewes and undersized and badly-formed sheep.

20. Our last lambing season was again very successful. The rams were put with the ewes at about the same time as in the previous year, and the lambs were born at a time

when the hastily-grown grass, which follows the rains, had nearly disappeared. The milk of their dams had, therefore, none of the pernicious effects which the milk of ewes fed on hastily-grown immature grass generally has. A field of guinea grass and a few acres of gram were specially preserved for grazing the ewes after lambing. These fodders were very valuable in increasing the flow of milk. The ewes and their lambs were, as last season, confined in the sheds until three or four weeks after lambing. This, I think, is very necessary during the hot weather we usually experience in March. Two seasons ago we lost many lambs by exposing them at *too* early an age to the hot sun of March and April.

21. Little can be done in this part of India in producing wool; nor could anything else be expected, where the thermometer freely exposed will at mid-day at certain seasons of the year register as high as 140 degrees, and where the average temperature of night and day *for the whole year is above* 80 *degrees.* Some of our Sydapet rams have yielded as much as 3½ pounds of wool—*a bulk that in England would weigh five or six pounds :* it is so *extremely dry ;* but two pounds of wool per head is about the average yield of our sheep. Last season we clipped 120 sheep (yearlings and ewes), and the total clip only weighed 218 pounds, or 1·81 pounds per head. However, there is little or no sale in this district for wool. During the past three seasons our wool has only averaged 1½ annas per pound. It was principally sold to coach-builders for stuffing carriage cushions, &c. Our clips are *too* small to make it worth while sending them to England.

Pigs.

22. *Pigs.*—An improvement has been effected in the housing of the pigs which promises to yield good results. They were formerly kept in ordinary styes floored with asphalte, the styes being provided with urine tanks. The arrangement had been in operation for several years, and seemed to be as good as could be devised; however, the results never were satisfactory. The urine made ruts in the asphalte, and never passed entirely into the tanks, thus stagnating on the floors and causing a very offensive smell in the proximity of the styes; but the chief fault was the liability of the pigs reared in these styes to go lame, generally when about half grown. So common was this, that it was only with the utmost care that we were able to rear a sound pig. I found that covering the asphalte with sand or with straw was alike useless, owing to the slope of the floors the covering always washed down from the higher level. It is difficult to explain why asphalte is thus injurious to pigs; but I have known several instances in England where it has been necessary to remove the asphalte floors of pig styes and substitute flooring bricks. Probably, the injury is due, to some extent, to the non-absorptive property of the substance, moisture remaining a long time on its surface during damp weather, and thus generating rheumatism and similar complaints, to the attacks of which pigs are very liable. On the opening of the Model Farm I erected a number of pig styes in which to feed porkers for sale, and, being anxious to keep down the cost of the buildings as much as possible, did not use asphalte for floors, determining first to test whether the arrangements carried out in the loose box system (which had with cattle produced such good results) would be as successful when applied to pigs. The results were so satisfactory that I altogether abandoned the intention of putting down asphalte floors, and have since put all the pigs into loose boxes with ordinary earthern floors. These boxes vary in area from 200 to 400 square feet; the former is the size allowed for a large sow and a litter of young, and the latter for five or six half grown sows or hogs. The roof of the shed is supported on brick and chunam pillars about six feet in height; a rail fence about four feet high surrounds the whole building, and the divisions or boxes are formed by partition railings. The floors are sunk about 1½ feet below the level of the surrounding ground; precautions are taken to prevent the surface water from flowing in; and the eaves of the roof project about two feet, so that the roof water falls clear and does not get into the bedding. At starting, a layer of ashes is spread over the floor of the box, and afterwards bedding to the depth of five or six inches. The pigs are then allowed to enter the pens. In the course of a few days the bedding is trodden down to half its former height and becomes more or less solid, as the pigs are large or small. It is then only necessary to add a slight surface dressing of bedding when needed. In this way both the liquid and solid manure is all retained in the straw, and the under-stratum made into an excellent manure, the surface

being as clean-looking as could be desired, while *there is an entire absence of all smell.* I have now for some time watched the habits of the pigs under the old and under the new systems, and most unhesitatingly give the preference to the latter, as under it the pigs are far healthier and much more cleanly, and they are decidedly placed in more favorable circumstances to cultivate cleanly habits than are nine-tenths of the pigs that furnish the prime Irish bacon, so highly esteemed in our home markets. We have, at the present time, the whole of our pig stock on both farms in these loose boxes, and they enjoy good health, are far more cleanly in their habits, and get a great deal more exercise than in the old styes; while *the whole of the manure is saved,* the unpleasant smell which formerly hung continually around the styes is removed, and there is a considerable saving in the labor of attending the pigs. When the pigs were first put into the loose boxes we unfortunately took no precautions against the heat, which just at that time was excessive, and lost two of them by heat apoplexy. Though the average temperature of the greater part of their new quarters is considerably lower than that of the styes they formerly occupied, yet unfortunately the western side, consisting of open railing, was at the time exposed to the direct rays of the sun, and to this side several of the pigs pertinaciously kept, the result being that when attention was drawn to the matter, three of them were found to be seriously unwell. By the free use of cold water one was brought round, but the other two died. Steps were then taken to keep out the *direct* rays of the sun, and the pigs have since enjoyed perfect health. I have recorded this incident, as it shows that great care should be exercised at certain seasons of the year to protect pigs from the sun, to the injurious influence of which they are more susceptible than is generally supposed.

23. A number of porkers were fattened. The general results were very satisfactory. The following experiments were made to ascertain the relative values of ground-nut cake and maize as foods for fattening pigs, and to ascertain the cost of producing a pound of pork: four young pigs were selected; they were nearly equal in age and in size; they were placed in loose boxes two in each. Those in pen No. 1 were fed daily on four pounds of ground-nut oil-cake and four pounds of tour, and those in No. 2 pen received daily four pounds of maize and four pounds of tour. Besides these foods a quantity of green fodder was thrown into each pen two or three times a day, the pigs in the two pens having a similar supply. The pigs were weighed at the end of every week. At the commencement of the experiment the two pigs fed on the cake and tour weighed together 236 pounds; at the termination of the experiment, eight weeks afterwards, they weighed 335 pounds, having increased 99 pounds in the interval. The details are as follow:—

Pen No. 1.	—	1st Weighing	2nd Weighing	3rd Weighing	4th Weighing	5th Weighing	6th Weighing	7th Weighing	8th Weighing	9th Weighing
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
	Two pigs fed on cake and tour	236	254	257	257	267	280	314	323	335

The two fed on maize and tour weighed together at the commencement of the experiment 255 pounds, and eight weeks afterwards, when the experiment terminated, they weighed 344 pounds, having increased 89 pounds. The details are as follow:—

Pen No. 2.	—	1st Weighing	2nd Weighing	3rd Weighing	4th Weighing	5th Weighing	6th Weighing	7th Weighing	8th Weighing	9th Weighing
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
	Two pigs fed on maize and tour	255	254	265	270	282	307	320	330	344

It would thus appear that, weight for weight, ground-nut cake is more valuable than maize for producing pork; but the superiority of ground-nut cake becomes much more apparent when we calculate the cost of the pork produced by each of these foods. The average cost of the cake was 85 pounds per rupee, while the average cost of the maize was 40 pounds per rupee.

24. During the eight weeks over which the experiment extended, the cost of the food consumed by the pigs in pen No. 1 (excluding the green fodder, the cost of which was more than recovered in the manure) was Rupees 2-10-1 for cake, and Rupees 1-12-0 for the tour, or together Rupees 4-6-1. The total increase in the weight of the pigs was 99 pounds. At 60 per cent. (the usual proportion in such pigs) the increase would represent 59¼ pounds of pork, produced at a cost of Annas 1-4 per pound. Valuing the pork at the regular market price Annas 4 per pound, the value of the increase will be Rupees 14-13-0, leaving after deducting the cost of production a profit of Rupees 10-6-11 for two months' feeding.

25. The cost of the maize and tour consumed by the pigs in pen No. 2, while the experiment lasted, was Rupees 7-5-7. They gave a total increase of 89 pounds, which, estimated in the same way as the increase in the pigs in No. 1 pen, would represent 53¼ pounds of pork, produced at a cost of Annas 2-2 per pound. Valuing the pork at 4 annas per pound, and deducting the cost of the food consumed, a profit, amounting to Rupees 5-15-5, was made on two months' feeding.

26. I have reduced the results of these experiments to a question of profit or loss; but it would be very erroneous to assume that the profits in this department of the farmer's vocation can be estimated in a similar manner, and that to obtain an income of 250 rupees a month, it is only necessary to keep a fattening stock of 50 pigs. As I have shown it *is possible* in pig-fattening to make a profit of 5 rupees per head per month; but my experiments were instituted for a *special purpose*, and were *not* made with the view of determining the commercial results of pig-fattening. To ascertain this, it would have been necessary to have fed a much larger number of pigs, and to have conducted the experiment over a much longer period of time. Losses by sickness or by accidents occur at irregular periods. During one half of the year no losses may occur, and the results may seem highly gratifying; but in the remaining six months, the losses may be such as to make the results of the twelve months' feeding a loss instead of a *gain*. However, in connexion with general agricultural practice, pig-fattening is certainly remunerative, and is worthy of much more attention than it has heretofore received.

27. Residents in up-country stations would undoubtedly find pig-fattening well worth their attention. Mutton clubs exist in many such stations. They are seldom successful, and the mutton is generally produced at a *great* cost. If some of these clubs, in addition to fattening sheep, would fatten a few pigs, they might produce pork of really good quality at half, certainly less than two-thirds of the cost of the mutton they now produce, while an agreeable change would be introduced at the dinner table. There are many situations in which grazing ground cannot be obtained, and sheep do not do well in confinement, unless *very* carefully fed and attended; but pigs can be kept almost anywhere. Very inexpensive sheds only are necessary. They can be fattened on low-priced food and garden stuff, while a large amount of vegetable refuse from the house, which is now wasted, might be usefully employed in feeding pigs. *In this country under proper supervision pig-feeding can be conducted with as much regard to cleanliness as in any other country*, and *really* good pork can be produced at a *moderate* expense.

Poultry.

28. *Poultry.*—The cross between the Brahma Pootra cock and Dorking hen, imported from Sydney in 1868, continues to be highly appreciated. These fowls have been widely spread over the Presidency. In the district around Madras there are great numbers. In appearance, they are more like the Brahma Pootra than the Dorking; are about the size of the former; have generally dark grey plumage; frequently have yellow legs; seldom have more than four toes on each foot; and are generally heavily feathered about the feet and lower part

of the legs. They thrive well on the plains, and during the hot season do not appear to suffer more than indigenous breeds of poultry. When properly fed they are good layers. Their eggs are much larger than the eggs of the country hen. They can be fed up to six or seven pounds weight at nine or ten months old. Their flesh is good, but not quite equal to that of the Dorking.

29. A highly successful experiment has been made in breeding back from this cross to the Dorking. Shortly after the fowls were imported, a lady purchased a setting of their eggs. When these hatched she noticed that two of the chickens were very different from the others. They were larger, rounder, and their plumage was whiter, while one had five toes on each foot, and the other five toes on one foot, and four on the other, the remainder of the chickens having only four toes on each foot. She reared these two chickens with great care. They throve well. When four months old the cock weighed about 4½ pounds, and the hen about four pounds. When the hen was properly matured, her eggs were *all* reserved for setting, and from them a number of very fine chickens were obtained. These chickens were in turn reared with the same care as their parents had been, and when matured their eggs also were reserved for setting, and thus, after three years, at a considerable amount of personal trouble, and by the exercise of good judgment, a breed of fowls has been established equal in most respects to the Dorking. They are very handsome birds, and seem as well suited to the climate of Madras, as are the indigenous fowls of the district. The color of their plumage is a silver grey. They are as large as the birds of the Brahma cross ; but are much more economical for the table, as, from their shorter legs and necks, there is less of the coarser parts, while the breast and most valuable parts are heavily covered with flesh. These fowls produce much larger eggs than country fowls, while they lay quite as many. An average sized egg weighs about 2¼ ounces, while an ordinary country egg only weighs about 1¼ ounces. The improved breed is yet far from being true to a type ; for in every setting of eggs there is generally three or four birds of an indifferent form ; still by persisting in the same course and by liberal weeding, there is no doubt but that ultimately all the most desirable attributes in a fowl will be *permanently* stamped on the birds of this breed. Many attempts have been made in this part of the Presidency to introduce the pure Dorking, but I am not aware of a single instance in which the attempt has been successful, while I could record many disastrous failures. Should subsequent experience confirm the results just recorded, and the Dorking fowl or a breed possessing all its qualities can be introduced through a cross with some other breed of poultry better suited to a hot climate, the result of this experiment will be very gratifying. It seems scarcely necessary to observe that by *breeding back* in this way a *pure* bred Dorking never can be obtained ; but, after a few years' successful breeding, so as *to fix the type,* the bird produced will so nearly resemble the pure bred Dorking that it will be impossible to distinguish it from one.

30. During the past few months cocks of the improved breed have been used on both farms with considerable success. The chickens are much superior to those by cocks of the imported cross, while they meet with a much more ready sale.

31. A very interesting experiment has been commenced in the Wudder village on the Farm Estate, the object being to improve the breed of fowls reared by villagers for the market. The village contains about 150 families of Wudders, and the greater number of these keep fowls. The Wudders promised that, if a certain number of cocks of the improved breed were supplied to them, they would take great care of them and would not sell or kill them, while they would kill every cock of the country breed belonging to the village. They have kept their promise very fairly. There are yet a few cocks of the old breed in the village, but these they promise to kill, as soon as the full number of cocks promised to them has been supplied. At first, the experiment promised to be anything but successful. Several of the first batch of birds died shortly after they came into the possession of the Wudders ; for a time it was difficult to understand this ; however, a little inquiry convinced me that it was entirely owing to the wretched accommodation provided for the fowls at night. I found that eight or nine, and sometimes more fowls, were confined from sunset until sunrise in a brick and mud erection measuring about three feet each way outside measure, and certainly not containing eight cubic feet of space inside. This place, as soon

as the fowls were put inside, was almost hermetically sealed, there being scarcely a single aperture for ventilating purposes. The dead birds presented all the appearance of having been suffocated. It was not in the least surprising that birds which had been reared with care, and which had been housed at night in a well-ventilated apartment, should be suffocated in the place provided for them by the Wudders, even though, in these same places, fowls of the country breed seemed to suffer little or nothing. However, the difficulty of getting ventilation without admitting snakes and other foes to the birds has been overcome, chiefly, I believe, by introducing a long bamboo tube in the roof of the roosting place. The fowls now appear to be thriving. There is, at the present time, about 150 chickens of the new cross. These chickens are generally light-colored, and are much larger than chickens of the country breed. The Wudders are, I believe, much satisfied with the result of the experiment. I have dwelt at an unusual length on the subject of poultry, as, I believe, that much good in improving the breed can be done in this way at a *very moderate cost*. All natives appreciate a *good* fowl, and, under the village organization, it is so easy to effect any improvement in the village poultry. By distributing good cocks to the villagers they become common property, and the whole community, who are all owners of poultry, benefit by their presence.

32. I must add a few lines on the subject of feeding poultry with ground-nut oil-cake, as I have found that this food with wheat bran (one of the former with two of the latter by weight) forms a most excellent diet for them. The flavor of their eggs is very much improved—a matter of considerable importance, seeing that most of the eggs in this country have a fishy unpleasant taste. Fowls fatten rapidly on this food, and the flesh of fowls so fed is superior to the flesh of grain-fed fowls.

Rabbits.

33. *Rabbits.*—Nothing has been done to improve the breed of rabbits beyond bringing them to an uniform color (grey). They thrive satisfactorily, and are prolific; but great numbers of young die before reaching maturity, or are killed by snakes, kites, crows, rats, &c. Their flesh is very tasteless, but, probably, if when able to take care of themselves, they were allowed to roam at pleasure; they might select herbs, &c., which would improve its flavor, while the exercise would also have a beneficial effect; however, the good gained in this way would be more than negatived by the damage they would commit on growing crops and young trees.

Crops.

34. *Carolina Paddy.*—No experiments were made with Carolina paddy last season on this farm, as previous experiments have indicated in a sufficiently conclusive way the conditions which are necessary for its successful cultivation in this district; but a quantity of seed was sown on the Model Farm as an *ordinary* field crop, and, as in reporting on the Model Farm it is inconvenient to deal with details, I will briefly narrate here the general results of these sowings. The total quantity of seed sown was 300 pounds, and the yield of grain was 2,929 pounds, but this was not the full out-turn, for a considerable proportion of the growing paddy was cut for fodder, as its appearance was not such as to justify me in keeping it for the production of grain. About the time the Carolina paddy was sown, we sowed on some adjoining land of a similar kind 350 pounds of country (chumba) paddy. This received the same treatment as the Carolina. It grew very satisfactorily, and yielded 7,002 pounds of grain.

35. Of course, these results afford no evidence as to the comparative merits of the two varieties of paddy; for the Carolina paddy was sown under unfavorable circumstances, the physical condition of the land being at the time very unsatisfactory. This, I trusted, would to some extent be remedied under the influence of a *favorable* season. However, my hopes of a favorable season were not realized, for the excessive rain of November greatly increased the disadvantages under which the crop labored.

36. I report these results, as showing how the one variety of paddy will grow and even thrive under circumstances that to the other would be highly prejudicial; but from this, we

are not to infer that the former is the better variety of paddy, though for such specially *unfavorable* circumstances it is undoubtedly the best. It is a well known fact that there are many districts in England in which the highly bred short horn cannot maintain itself without the aid of artificial keep, where Irish and other unimproved breeds of cattle will not only maintain themselves, but even thrive, yet no one infers from this that unimproved cattle are superior to short horns. The fact is unimproved varieties of plants like unimproved breeds of animals suffer less when opposed by unfavorable circumstances than do the more highly developed. Carolina paddy is an improved variety of paddy, which has been carefully reared on the rich virgin soils of South Carolina.

37. Our last year's experience on the Model Farm proves, not only that remunerative crops of country paddy can be produced on a soil that altogether fails in producing a fair crop of Carolina paddy, but also that a soil which one year produces good crops of this grain may, in the next year, not be able to produce even half a crop. Thus, soils which in 1870 produced as much as 40 bushels per acre of Carolina paddy yielded last season only half as much, though equally as well cultivated and manured, but the explanation of this is simple ; the soils which produced such good crops of Carolina paddy in 1870 were in a fresh state at the time the paddy was sown ; they had not been under wet cultivation for several years, while those sown last year with this paddy were under wet cultivation in the *previous* year, and had become more or less reduced, by the stagnation of the irrigating water in the sub-soil, to the condition of the more inferior description of paddy land, or, in other words, to a sour, unhealthy, soapy condition, in which atmospheric agencies could have no effect for good, in which plant food is either locked up and rendered inert, or forms combinations more or less injurious to vegetable life, but whose surface to a depth of two or three inches is more or less healthy and capable of producing plants of a low type. It is easy to understand why, on a soil in this condition, Carolina paddy seldom does well, while country paddy may thrive. The former feeds deep down in the soil, it has long deep roots, varying in length, under average circumstances from four to six inches, while few of the rootlets are horizontal. It is very different with the roots of country paddy ; nearly the whole of its rootlets radiate over the surface of the ground at right-angles to the stem of the plant. They are seldom more than two or three inches in length, and are so interwoven as to form a sort of network well suited for supporting the plant on the semi-liquid mud in which this paddy delights to grow. Hence a soil in a bad physical state, if it only has a healthy surface two or three inches in depth, may produce fair crops of country paddy, though it will entirely fail in producing a crop of Carolina paddy. On such a soil the Carolina paddy would start, as well as the country paddy, and would continue to grow as well, *until its roots begin to penetrate below the aërated soil,* when its growth would be checked, and it would gradually turn yellow and sicken. The fact is, Carolina paddy cultivation belongs to a higher condition of agricultural practice than has yet been reached in this country.

38. I believe that those who have suggested that paddy land should be sub-soil drained have *common sense* on their side. We do not require to make our lands into *swamps, to enable us to get good results from irrigation,* unless, indeed, we wish to confine our practice to the culture of *low* types of agricultural plants. *Merely pouring water into a paddy field,* floored with an impervious sub-soil, *is not making the best use of irrigation. The water must pass through,* and *not merely into the soil.* We want *perfect filtration,* in which the water will pass down through the soil, and away by sub-soil drainage, either artificial or natural. Until we possess this, we cannot hope on ordinary wet land to grow high types of plants. I form these conclusions, not solely on the necessarily limited number of experiments that have been conducted on the farms under my charge, but on observations made over a wide area of Southern India, aided by a knowledge of the results of hundreds of experiments made in Carolina paddy cultivation during the past few years in *all* parts of this Presidency.

39. Opinions have been expressed that Carolina paddy will deteriorate in this country, but this *need not necessarily* follow. Carolina paddy, which has been grown in this country under suitable circumstances, is in no way inferior to the seed imported from America. One of the best crops I grew last season (2,000 lbs. per acre) was from seed in the third generation since imported, and I have just issued a fine parcel of grain (the fifth generation) the product

of seed, which formed part of the yield of that crop, and this was quite equal to the seed we imported from America.

40. Deterioration does undoubtedly take place when the crop is grown under *very* unfavorable circumstances; but it must be remembered that the finest of our wheats and barleys deteriorate in the *best* wheat and barley-producing districts in England, if sown at the wrong season on exhausted soils imperfectly cultivated. But deterioration is less to be feared than *the loss of purity in the sample.* Fully 50 per cent. of the samples of country-grown Carolina paddy that have been forwarded to me contained indigenous paddy, varying in amount *from* 10 *to* 50 *per cent.* The presence of this country paddy amongst the Carolina grain is altogether due to the *late* period in growth at which ryots harvest their paddy. They generally wait until the crop is *dead* ripe, when from 10 to 15 per cent. of the grain is invariably shed by the wind; and, in harvesting the crop, the result being that, after the removal of a crop of country paddy, the soil generally is sufficiently well seeded for another crop.

41. When it is intended to grow Carolina paddy on old paddy land, the soil should be invariably watered and stirred a few days before the day fixed for sowing. The seed already in the soil will thus be induced to germinate, and can be ploughed in and killed.

42. In preparing rice from ordinary Carolina paddy, by means of the pestle and mortar, in the usual manner adopted by natives, the following results were obtained:—

	Per cent.
Clean rice	67·24
Small rice	8·48
Tour	5·24
Husks, &c	19·04
	100·00

43. *Tapioca.*—A piece of land, measuring about 1,200 square yards, was planted with tapioca cuttings. The experiment was suggested by His Highness the First Prince of Travancore, to whom we were also indebted for the cuttings. The land planted was a piece of poor sandy soil, of which we have such a considerable area on the western side of the Experimental Farm. A stiffer soil could have been provided, had this been thought necessary, but the small experiments made in previous years on moderately heavy soil seemed to indicate that a stiff soil was not the most suitable; while it is a well known fact that starch is developed more freely in tubers, bulbs, and fleshy roots, when the soil in which they are growing is free and thoroughly aërated than when it is stiff and compact, and the commercial part of tapioca chiefly consists of starch. The soil was naturally a very poor one, and contained fully 90 per cent. of sand, but, to some extent, we compensated for its poverty by giving it a *heavy* dressing of foldyard manure. The land was first thoroughly ploughed, grubbed, and weeded. It was then raised in ridges about 30 inches apart by the plough, and the manure was spread in the open furrows between the ridges. The plough was then passed along through the centre of the ridges, throwing the soil over the manure on each side, thus raising a new ridge immediately over the manure. The cuttings were planted on the 17th of July on the ridges, in pairs crossing each other obliquely, each pair being planted about three feet apart; the ground being exceedingly dry at the time, the cuttings were twice watered (with chatties). They were afterwards left *entirely* to the weather, and received no other attention, except a slight weeding. The plants grew well and vigorously, and look promising, but they are certainly too heavily covered with leaves, for such a light soil as that in which they are growing, a very slight storm would prostrate them. The sandy soil seems suitable, but we have evidently used too much foldyard manure (box manure rich in nitrogenous, or leaf-producing matters). Had we used less of the foldyard manure, and with it a small quantity of some phosphatic manure (bone dust, or animal charcoal) a good result would, I fancy, be more certain.*

* Unfortunately my worst apprehensions were realized, for, during the cyclone which broke over this district in the early part of May, the whole crop was prostrated, and nearly the whole of the plants were permanently injured. I had, therefore, no alternative but to gather the crop. The tubers weighed 656 pound; but, as they were not matured, they possessed no commercial value.

44. *Areca-nuts.*—A quantity of areca-nuts were obtained from the Western Coast. A few were injured by heating on the way here, but most of them germinated. They were planted out on a piece of open ground, which had been well cultivated and manured, having a good drainage, both surface and sub-soil. They were watered when necessary, and the soil about them was kept open and free from weeds. For the first few months they appeared promising; after this they gradually turned yellow and sickened, and one by one died off; only a few plants have survived, and they are sickly-looking. I am inclined to think that, had we planted under shade, we would have had more satisfactory results, as the plants exposed to the full glare of the sun suffered most; and I have since learnt that, on the Western Coast, where the climate is more moist than here, it is usual to plant areca-nuts under the shade of plantains, but whether or not the scorching weather experienced here for six months in the year is against their general cultivation in this district, I am decidedly of opinion that they need too much attention to make them a remunerative crop where the labor required must all be hired.

45. *Prairie grass* (*Bromus unioloidus.*)—The prairie grass referred to in my last report has not turned out satisfactorily. It grew fairly during the cold weather, but gradually died off, as the temperature increased. It stands long and severe droughts in Australia in districts where the temperature is reported at times to rise nearly as high as it does here; but the grass evidently cannot withstand the effects of the dry scorching weather experienced in this part of India during the months of April, May, and June.

46. *Guinea grass.*—We have considerably extended the area of land under this valuable fodder plant. The better I become acquainted with guinea grass, the more I value it. Many erroneous ideas are prevalent regarding guinea grass and its habits, most of which have originated with superficial observers, whose experience has been confined to the cultivation of small plots of the grass in kitchen gardens. When I commenced to grow guinea grass I had unfortunately no other experience before me, and when I penned my report for 1870, having then but a very short personal experience in growing the crop, I unfortunately fell into the error of promulgating these mistaken ideas; however, it is still said that guinea grass must be irrigated, not only at the time it is planted, but regularly at stated intervals afterwards; that it must be taken up and be replanted on new ground at the end of every two years at the furthest, and that the fodder is *not* a suitable food for stock, and can only be used in small quantities for such a purpose. Now, my experience in growing guinea grass during the past three years leads me to form very different conclusions. I have very fine crops, which never were irrigated. I have a field of two acres better now than ever it was, which was planted nearly four years ago; while some of the best results I have obtained in fattening stock were obtained with guinea grass. It is perfectly true that, if guinea grass is planted in the hot season, or during dry weather, when the soil contains scarcely a particle of moisture, and the sky is clear and bright, that the plants will fail completely if not watered a few times; but there can seldom be any necessity for planting under *such* circumstances. In the dryest parts of the country there is always a time when the sky is cloudy and the weather showery, and, if such opportunities are properly utilized for planting, the roots can be established sufficiently well without the aid of irrigation. But to obtain the best results the land must be well prepared. The following is the practice we pursue:—Plough, scarify, and weed the land thoroughly; harrow, roll, and pulverize to a fine tilth; then ridge with the plough, making the ridges at distances of about two feet. Manure is then spread in the open furrow between the ridges. The plough is then passed along the line of the ridges, splitting them in the centre and throwing the soil over the manure on either side. The chain harrow or the roller is then passed along over the surface of the ridges to consolidate them, and the plants (obtained by dividing into several parts old tussacks from another field) are planted on the ridge on the first showery day, afterwards care being taken that they are planted uniformly at a distance of two feet apart in each direction; thus, admitting of the plough being used between the lines of plants and across these lines at right angles. The after-cultivation is simple; little weeding is required if the crop was well manured at planting, but it is advisable to pass the plough or cultivator occasionally through and across the crop, as the absorptive powers of the soil can in this

way be kept up. This ploughing or cultivating should be repeated at any rate once after the removal of each cutting. A dressing of foldyard manure should be applied between the plants and ploughed in at least once a year. Before the end of the second year the plants from frequent cutting will have formed large tussacks. These must be reduced by simple chopping with a spade, hoe, or mamuttee. We find it best to make two cuts across the tussacks at right angles to each other, thus dividing it into four parts. Of these, three are removed, and form excellent bedding for the cattle stalls, the fourth remaining to perpetuate the crop. In this way there is no necessity to remove the plants to other ground, but care must be exercised to see that the soil is *properly* manured, as a crop which yields such *large* returns must necessarily make large demands on the soil. The fodder can be used for all kinds of stock; at first, it seems to disturb the digestive organs of some animals, but this is only temporary. I have fed cattle and sheep on it *exclusively* for *months*, not only without any ill-effects, but with the most satisfactory results. I have found our guinea grass field a capital place in which to graze our working cattle during the hot season and for the ewes with young lambs, I could scarcely desire a better pasture. It produces such an abundant flow of milk in the ewes, without, what is common in such cases, disturbing the health of either mother or lamb.

47. *Chinese Sugar-cane* (*Sorghum Saccharatum*).—This crop, which we introduced from Sydney in the early part of 1870, has now established itself here as one of our regular cold weather crops. A large quantity of seed has been distributed over the country, and satisfactory results have been obtained in most instances. From Bangalore the reports are *very* encouraging; the crop seems specially suited to the more temperate climate of Mysore.

48. We had a considerable area of land under sorghum last season. The general results were satisfactory, but not equal to those obtained in the previous year. This is chiefly to be attributed to the long drought which prevailed during the two months preceding the harvesting of the crop.

49. Sorghum can be grown as readily and with as little skill as the ordinary cholums of the ryot, though, unlike our cholums, *good results cannot be obtained from hot weather sowings.* I have tried sorghum over and over again in the hot season, but every time with the same want of success, even when the crop was occasionally irrigated. The seed always germinated well, and there were plenty of plants, but they were invariably sickly and stunted, and we never, even in the most favorable circumstances, obtained more than one-fourth of an average cold weather crop. This is very different from our cholums, which with water will grow well at any time of the year, and frequently better in the hot weather than in the cold season. This is a drawback to the utility of sorghum as a fodder-producer for *general* use; however, I am not without hope of being able to establish a variety of sorghum, which will grow in the *hot weather;* accident will often effect what skill cannot, excepting at the expenditure of a considerable amount of labor and a great loss of time. Thus, in the last hot season, I noticed growing amongst our cumboo crops some fine sorghum plants, which had been produced from sorghum seed brought to the field in the manure from stalls in which the cattle had been fed on sorghum fodder. The plants were allowed to mature their seed, which was carefully collected, and will be sown again in next hot season. The produce will again be carefully collected for hot weather sowing, until this peculiarity of the plant is established. It was in this way that the English farmer established his *spring* wheats and *winter* wheats. It will be a fortunate occurrence if we succeed in establishing a hot weather as well as a cold weather sorghum.

50. We usually put in our sorghum crop in a very simple way. The land is first ploughed, scarified, and weeded, and then the manure is broad-casted over its surface. This is then ploughed in, and the land is harrowed along the lines, the plough travelled (not across, as the harrow would pull up the manure). It is then rolled, and the seed is sown with the seed drill (the country bamboo drill answers admirably) at distances varying from 12 inches to 18 inches, according to the richness of the soil, at the rate of from 12 to 15 pounds per acre.

51. We have occasionally steeped the seed before sowing it, but I find that in dry weather the seed is more liable to suffer injury, by being steeped and softened before being

sown, while in damp weather there is *no necessity* for steeping it. We have also sown sorghum on ridges, and this is the best way to get a *large* crop, but it is rather a tedious process in a *hasty* season, and cannot always be adopted. The land is prepared, as for sowing, on the flat up to the time it is pulverized and cleaned: it is then ridged up by means of a plough in ridges about two feet apart. Manure is spread in the furrow between the ridges, and is covered by passing the plough along through the drills. The ridges raised over the manure are either rolled or harrowed, and the seed is sown along their tops. When the plant is grown under irrigation the practice just detailed is followed, and the water is allowed to flow between the ridges on which the crop is growing. It has been suggested that transplanting might suit the habits of the sorghum plant, but it is seldom in this country that this can be done without *great* expense and seriously delaying farm-work. Transplanting may answer well enough for planting a few square yards with Sorghum in a kitchen garden, but is altogether unsuited for operations in the field, excepting perhaps under irrigation.

52. *Country paddy as a fodder crop.*—A considerable area of land was planted with country paddy for fodder. The general results of the experiments were highly satisfactory.

53. The crops were grown in the usual way. Some were produced from seed and others from transplanted seedlings. As a general rule, the best results were obtained from seed which had been sown broadcast.

54. The fodder was harvested when the plants were in the shot blade, just before the ear appeared. The following are the results of three small experiments made in growing paddy fodder :—

Grain.	Number of Days between sowing and harvesting.	Seed sown.	Area of Plot.	Weight of Fodder.	Weight of Fodder per Acre.
		lbs.	Sqr. Yds.	lbs.	lbs.
Car paddy	120	30	1,320	5,348	19,609
Do.	132	25	1,056	4,508	20,662
Do.	135	15	630	2,016	15,488

An average of 18,586 pounds per acre is very satisfactory, especially as the cost of production is so low. The following may be taken as the average cost per acre incurred in producing the results just reported :—

	Rs.	A.	P.
Ploughing, &c.	3	0	0
Seed and sowing	1	8	0
Manure	3	8	0
Watering	7	0	0
Weeding	2	8	0
Harvesting and bringing to stackyard	1	12	0
Other expenses	0	12	0
Total ...	20	0	0

The fodder is thus produced at the rate of 929 pounds per 1 rupee, or at about Rs. 2-6-7 per ton. These results are in no respect exceptional. It is in the power of every ryot, who owns ordinary paddy soil with a moderate supply of water to produce similar results, while those who can apply the irrigation water by gravitation can produce it at a much lower cost. There are few districts in which the stock-owner cannot afford to give 5 rupees per ton for such fodder, and this price would leave the ryot a profit of upwards of 20 rupees per acre—a much better result, I fancy, than he generally obtains by allowing the paddy to mature its grain, and he can, under average circumstances, grow three crops of the fodder in the time he would grow two crops of grain.

55. Owners of horses could effect a very considerable saving in the cost of their stables by substituting paddy fodder for a portion of the grass now supplied by grass cutters. At the rate of wages usually paid to these people, this grass seldom costs less than 12 rupees per ton.

56. The nutritive value of the fodder will much depend on the condition of the soil which produced it. A soil that is naturally rich, or that has been highly manured, will yield a more nutritious fodder than a soil in a more or less exhausted condition. To test the nutritive values of paddy fodder, we have tried it against grass (ordinary grass supplied by grass cutters, the best standard we possess) produced on a soil of a similar character, and in each instance the animals experimented upon were full grown. The following are some of the results obtained :—

A pair of working cattle were selected, (of course similarly worked) ; one animal was fed on the grass before alluded to, and the other on paddy fodder. Each forage was given at the rate of 30 pounds per animal, and each animal received in addition four pounds of oil-cake. They were weighed at the end of every seven days. The following are the details :—

—	1st Weighing	2nd Weighing	3rd Weighing	4th Weighing	5th Weighing	6th Weighing	7th Weighing	8th Weighing	9th Weighing	10th Weighing	Remarks.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1 Pair of working cattle.	784	826	836	846	850	860	854	882	876	870	Animal fed on paddy fodder.
	870	870	840	835	842	868	852	864	861	859	Animal fed on grass.

57. A similar experiment was made on sheep. Four full grown store sheep were selected ; they were placed in two pens, two in each. Those in pen No. 1 received daily 15 lbs. of paddy fodder, 2 lbs. of oil-cake, and 2 lbs. of tour ; those in pen No. 2 received daily 15 lbs. of ordinary grass, 2 lbs. of oil-cake, and 2 lbs. of tour. The sheep in both pens were weighed at the end of every seven days. The weighings are as follow :—

—	1st Weighing	2nd Weighing	3rd Weighing	4th Weighing	5th Weighing	6th Weighing	7th Weighing	8th Weighing	9th Weighing	10th Weighing	Remarks.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Two sheep...	172	180	185	186	178	177	179	178	186	188	Animals fed on paddy fodder.
Two sheep...	154	166	166	166	167	155	160	160	163	167	Animals fed on grass.

58. Other experiments were made, the results of which agreed generally with those of the two experiments just reported. The results appear to be slightly in favor of the paddy fodder, but I am not inclined to attach much importance to this, as, with the greatest care, these weighing experiments are never *perfectly* accurate. They are liable to be influenced by the peculiarities of the constitutions of the animals fed. One animal may assimilate its food very thoroughly, and its powers of digestion may be very active, while another may have a weak imperfect digestion, and may digest its food very slowly, but making allowance for these differences, which cannot be controlled, weighing experiments in testing the feeding values of different fodders, provided the animals have been selected with due regard to age, sex, &c., are sufficiently accurate for all practical purposes, and the conclusion I arrive at on the foregoing results is that paddy fodder, grown under average circumstances, is, weight for weight, as nutritious as the grass, which is almost universally in this part of India used for feeding horses.

59. Paddy fodder can be made into hay, for which purpose it is as well suited as the oat, which in some countries is so largely used in making hay. It is perhaps rather too coarse a food for horses, excepting for those only employed at slow work ; but for cattle, either for draught or for dairy purposes, a *better food could not be desired.*

60. Of course, the distance from a market will limit the remunerative cultivation of paddy fodder to but a small area of the land now under paddy, still there is no doubt but that near our larger towns, within a distance of six or eight miles, a large proportion of the land might profitably be employed in growing fodder, not continuously, but in alternation with a crop of grain; and certainly during seasons of long drought, when cattle are starving and the ryot and his people idle, the drop of water available, though it would not nearly suffice to bring a crop of grain to maturity, *might be turned to account in growing a crop of paddy fodder.* It is lamentable at such times, when large tracts of country are lying idle and cattle dying off, to see here and there a few feet of water in the tanks left unused, because *there would not be enough to mature a crop,* when it might suffice for raising a crop of paddy fodder; but, if a *bad season comes,* the ryot *seems quite without resource;* he folds his arms and blames his unfortunate fate.

61. *Cotton.*—The field of western cotton, referred to in paragraph 174, page 23 of my last report, yielded 1,766 pounds of seed cotton, equal to 355 pounds per acre, and this, it must be remembered, was in addition to a crop of maize, which was grown in alternate rows with the cotton.

62. *Markham's Yca Valley cotton.*—This valuable species of cotton continues to thrive here, but so far it has not yielded as well as I had hoped it would. The quality of the cotton is certainly all that I could wish; indeed, I do not think that better cotton was ever produced in this country. Samples of the produce have been submitted to professional examination by His Grace the Secretary of State for India. The following is Dr. Forbes Watson's Report, through whom these valuations were obtained:—

"This cotton was submitted to, and valued at, from 10*d.* to 10½*d.* per pound by the Cotton Broker's Association in Liverpool. It was likewise valued by a firm of brokers in the same place, and at the same time, at from 10*d.* to 11*d.* per pound.

"It is considered to be similar to Peruvian cotton, and the prices named are nearly identical with those quoted for the best qualities ('good and fine') of Peruvian cotton at the same date, and it ranks higher than good 'Egyptian,' as will be seen from the subjoined table, which gives the means of comparing the value of the Yca valley sample from Madras with that of similar samples in the Liverpool market during the week ending 28th September last:—

Classification and Value per pound.

	"Ordinary."	"Middling."	"Fair."	"Good, Fair."	"Good."	"Fine."
Cotton from the Yca Valley seed grown in Madras in 1871, *value* 10*d.* *to* 11*d.* *per pound.*						
Peruvian	6¾	8	9⅛	9¾	10¼	10¾
Peruvian	...	8⅞	9⅜	9½	9¾	11½
Egyptian	7¼	8¼	9¼	9½	10¼	13

"It should be mentioned that, during the same period, American 'middling uplands' was selling at 9 7/16*d.* and American 'middling fair uplands' at 10⅜*d.* per pound, while the price of the two best sorts ('good') of Indian cotton in the market at the time, namely, 'Hinginghaut' and 'middling ginned broach' amounted to 8¾*d.* and 8⅝*d.* respectively.

(Signed) J. Forbes Watson.

63. Samples from the same bulk were also forwarded to England by Messrs. Arbuthnot & Co., of Madras, who kindly undertook to submit them for professional valuation. I am indebted to these gentlemen for the following report on these samples:—

"The samples of cotton have reached us, and have been carefully examined. There can be no doubt but that this is most excellent cotton, by far the best we have seen from your Presidency. It is a good deal mixed both as regards cleanliness and staple, the latter being

far from even throughout the sample. We enclose a detailed report and valuation, to which we may add that, if, as we hope and believe, it could be used for mixing with wool, there would be a very ready sale for it at high prices, but this is a point which it is difficult to ascertain without a sufficient quantity of the cotton to admit of the experiment."

LONDON,
3rd August 1871.

REPORT ON OVERLAND SAMPLE OF COTTON FROM MESSRS. ARBUTHNOT & Co.

"1*st*.—Rather mixed in color, part being very white, clean, and carefully ginned; the remainder dull, rather dead in color, and not so well ginned.

"2*nd*.—Partaking of the same character of the inferior portion of the first bale, but the whole of good staple, long and generally strong, but of woolly description and suitable for mixing with wool. The finer quality would probably bring 9½*d*. to 9¾*d*. per pound, and the other 9*d*. to 9¼*d*. per pound, and both be of ready sale."

"This cotton resembles a quality received from the Figi Islands, raised there we understand from seed imported from the Brazil."

64. The difference in these valuations may fairly be attributed to the fluctuations in the markets at the time, and to the different local demand in the two markets in which the cotton was submitted for valuation. The unanimous opinion as to the *high* character of the cotton is very gratifying and encouraging. It now only remains for us to collect as much seed as possible and to extend, under suitable conditions, the culture of this valuable plant.

65. As there has been some uncertainty as to the early history of this cotton, as far as its introduction into India is concerned, I am glad to be able to place on record the following facts:—The seed was introduced, by Mr. Clement Markham when engaged in introducing the cinchona plant into India from Peru. It was obtained from the coast valley of the Yca. During Mr. Markham's visit to this country in charge of the cinchona plants, it had occurred to him that many districts in the eastern part of the Presidency possessed the same conditions of climate as the coast of Peru, and he, therefore, suggested that the plant might be introduced with great advantage into this district. The first supply of seed seems to have been received in this country during the latter part of 1864. This was distributed by the Board of Revenue to the Collectors in charge of the districts referred to by Mr. Markham.

66. I am not aware that any marked result followed on the cultivation of this new species of cotton, nor do I know what became of the seed produced, excepting a few ounces given to me by the Honorable J. D. Sim, C.S.I., in 1870. From this small supply, I have during the past two years been able to plant five acres, and will be able to increase the supply of seed to any extent, when, on the establishment of our new district farms, we will possess a more suitable climate and soil for cotton cultivation; in the meantime, the plants will be well looked after. A portion of the seed obtained will be planted here on our most suitable soil, and the remainder will be distributed to persons likely to make good use of it.

67. The plant is a perennial. If left unpruned it will grow to the height of 8 or 10 feet. It can be propagated by cuttings, but the results are not so good as from seed. It bears transplanting well in the early stage of its growth, that is, before it is three months old; though, it may be transplanted even when *full* grown, but it does not bear well when transplanted out so late as this. I see no reason why, in suitable localities, it should not be planted along with coffee. The cultivation coffee generally receives is just the cultivation to suit this cotton, while it would not interfere with coffee, as its produce could be collected during the *slack* season. While during the first two or three years after planting the coffee, during which no income is obtained, the planter might do something to meet current expenses by growing cotton in this way. Such a practice would certainly enable men of smaller means to engage in coffee cultivation; and it must be remembered that *no agricultural enterprise is on a safe footing as long as it is dependent on the success of any single crop*.

68. The following shows the composition of an average sample of Yca valley seed cotton :—

	Per cent.
Clean cotton	38·07
Seed, &c.	61·93
	100·00

69. For comparison with the foregoing I record below the composition of two average samples of seed cotton of the Hinginghaut and Bunnie varieties (well known Bombay cottons) which we grew last season on a soil similar to that which produced the Yca valley cotton :—

	Hinginghaut per cent.	Bunnie, per cent.
Clean cotton	25·15	25·54
Seed, &c.	74·85	74·46
	100·00	100·00

70. *New Orleans cotton.*—This cotton has been *very* successfully grown on these farms during the past year. One experimental plot, measuring 5,600 square yards, was sown with this cotton and Australian maize in September last. The land was prepared in our usual way for maize—first, well ploughed ; then harrowed, rolled, weeded, &c. ; afterwards ridged at distances of 30 inches apart, in the furrow between these ridges farmyard manure was applied at the rate of 20 loads, or 8 tons per acre ; the ridges were then split through the centre with the plough, one-half being cast over the manure on either side, thus raising new ridges over the manure ; the ridges were then harrowed with the chain harrow to consolidate them, and maize and cotton were sown along their tops in alternate rows ; the chain harrow followed and completed the work. After the crop was a few inches high, a showery morning was selected, and the top dressing was broad-casted over the surface of the drills, and hoed in, with the hand-hoes and bullock-hoes, while engaged in cleaning the land. The following is an estimate of the cost per acre :—

	Rs.	A.	P.
Ploughing, pulverizing, and cleaning the land...	3	0	0
Ridging	0	8	0
Eight tons of manure	12	0	0
Carting and spreading manure	2	0	0
Splitting ridges	0	8	0
Chain-harrowing	0	2	0
Seed and sowing	1	0	0
Chain-harrowing	0	2	0
After cultivation.			
Hand-hoeing and bullock-hoeing	10	0	0
Top-dressing and cost of application	18	8	0
Harvesting maize, including reaping, removal to yard, shelling, winnowing, &c.	4	10	0
Gathering cotton, ginning, &c.	10	0	0
Total ...	62	6	0
Return per Acre.			
661 lbs. of seed cotton=189 lbs. clean cotton, at 120 rupees per candy	45	5	9
472 lbs. of cotton seed	4	0	0
1,793 lbs. of cobs=750 lbs. maize, at 45 lbs. per rupee ...	16	0	0
1,043 lbs. cob stalks, skins, &c.	3	8	0
3,889 lbs. of straw	15	0	0
Total ...	83	13	9

71. The results of this experiment in high cultivation are satisfactory. The crop has already returned Rupees 21-7-9 per acre *in excess of the cost of production,* while the value of the plants now standing for next year's crop, with the fertilizing qualities of the manure yet in the soil, will be worth, at the least, 15 rupees per acre more, making a total return of Rupees 36-7-9 per acre, to pay rent, interest on capital, cost of supervision, &c. Though the total cost of production is *high*, it must be remembered that, with the exception of the cost of the top-dressing, the whole of the expenditure is for ordinary farm labor and for manure produced on the farm itself. It will be seen that the farmyard manure applied was sold to the crop at Rupees 1-8-0 per ton, which is so much *additional* profit, as the manure was chiefly made by the working cattle, whose labor in producing these results had been charged for at *full* rates without any allowance for the manure they made.

72. It may be objected that in many parts of the Presidency straw is not a marketable commodity, and, therefore, should not have been valued, but the agricultural practice of that district must be poor indeed in which one rupee cannot be made from 250 pounds of straw, either by being used as food for stock, or for manufacturing manure; but against even this there is the fact that in many districts labor and cattle food are far less costly than here, while there are few soils under arable cultivation so poor as the soils that produced these results, an average analysis of which is given under the head "Tobacco." The result of the experiment is instructive in proving that, even the poorest soils under cultivation can, under a judicious system of manuring, be made to produce remunerative crops.

73. The cotton was ginned at the farm by one of Emery's gins, containing 13 saws, made by Burges and Key, worked by manual power and by cattle power; the latter we found produced by far the best results, thus:—

(*a.*) Six men working 7½ hours ginned 135 lbs. of seed cotton. In a full working day they would gin 162 lbs., and their wages would amount to Rupees 1-2-0, or Rupees 3-7-6 for every candy (500 lbs.) of seed cotton they ginned.

(*b.*) Two men, with one pair of cattle working 7¼ hours, ginned 262 lbs. of seed cotton. In a full working day they would gin 315 lbs., and their wages and the hire of cattle would amount to Annas 14, or Rupees 1-6-2 for every candy (500 lbs.) of seed cotton they ginned.

74. These experiments were made simply to test the relative cost of ginning by manual power and by cattle power. To ascertain the actual expense incurred in ginning a certain quantity of cotton, it will be necessary to add a certain sum to the cost of each day's work to provide for wear and tear, interest of capital, oil, &c.; but under ordinary circumstances these items need not exceed Annas 8 per day.

75. *Tobacco.*—In the Madras Experimental Farm Report for last year, at page 21, I recorded in some detail the cultivations performed on a few plots of tobacco. The crops not being harvested at the time I wrote, I was not able to offer any opinion as to the suitability of tobacco for such soils as we cultivate at Sydapet. I will now briefly refer to these experiments and to the conclusions they enabled me to form. The tobaccos were sown in January and harvested about four months afterwards; but perhaps it will be better that I should give the *actual* dates of sowing, harvesting, &c. Such information may be useful to intending tobacco growers.

	1871.			
	Date when sown.	Date when germinated.	Date when transplanted.	Date when harvested.
Manilla	4th January.	11th January.	3rd March.	10th May.
Godavery	do.	do.	27th Feb.	26th April.
Dindigul	do.	do.	3rd March.	do.
Madura	do.	do.	do.	do.

Several other varieties of tobaccos (country chiefly) were grown, but the dates of sowing, transplanting, &c., differed very little from the above. As the object of these experiments

was simply to ascertain whether our soils could, at a moderate cost, be made to yield a good marketable tobacco, we kept no records of the weight of leaf produced, but the results were in this respect all that could be desired; indeed, I never saw more regular or more abundant crops.

76. The leaves were cured in two different ways: some by the ordinary native process, and the remainder by the slower process usually followed in Europe. The operations performed under the first-mentioned system were conducted by a native who claims to be thoroughly acquainted with the ordinary methods adopted by native tobacco growers for curing and preparing tobacco. He took charge of the tobacco immediately after it was removed from the field, and was left at liberty to adopt any plan he preferred, being supplied with whatever he needed. I will describe *very* briefly the operations he performed, as the whole of the details have recently been so frequently described in the numerous replies received to the inquiries instituted by the Board of Revenue regarding the cultivation of tobacco in the different tobacco-growing districts of this Presidency. After removal from the field, the plants were hung over poles suspended a few feet above the ground. On these poles they remained for a couple of days, being fully exposed during the whole time. They were then taken down and carefully built in the form of a stack, its length being about twice as great as its breadth, and its height about three feet. This was covered with varagoo straw. After standing for seven days in this heap the tobacco, which had then begun to ferment, was removed and was suspended over lines in an open shed. Here it remained for a fortnight, when it was taken down, again made into a heap and covered as before, this time resting on green palmyra leaves. In this heap it remained untouched for ten days when it was turned the reverse way to that in which it was first placed, that is, the stems, which in the first instance were turned outwards, were now turned towards the centre of the heap, the whole being again well covered with straw. In this state it was allowed to remain for another period of ten days, and at the expiration of this time the heap was opened, each plant stalk was separately removed, and its leaves carefully stripped off; the bare stalks were thrown aside, and the leaves were made into bundles of 25 each. These bundles were again stacked on straw, with a quantity of the green leaves of the wild cashew tree mixed amongst them, and the heap or stack was again covered with varagoo straw, this time heavily weighted. In this state it was allowed to remain for eight days, when the tobacco bundles were again turned and a fresh supply of green cashew leaves mixed through, the whole being covered and weighted as before. These turnings were repeated three other times with the same intervals between, a fresh supply of green cashew leaves being used each time, while the heap was always kept thoroughly covered with straw pressed well down by heavy weights. From the time the leaves were removed from the stems these repeated turnings occupied nearly six weeks. I may add that at each turning the position of the bundles was so changed that every part of each bundle was in turn subjected to the greater heat of the inner part of the stack. The heap having been allowed to stand for eight days' after the fourth turning, was opened out, and a few stems of the plants, which had up to this time been fermented in the heap with the bundles of leaves, were removed. These tobacco stems were boiled in water, and the decoction obtained was afterwards employed in sprinkling each layer of bundles as they were being again rebuilt in a stack. In this stack the bundles remained until the following day, the violent fermentation produced by the sprinkling having, in the meantime, turned the leaves quite black. The bundles were now removed from the stack to an open shed to dry. They were placed in a vertical position with the leaf stalk downward, and were packed very lightly together so as to afford every means for a thorough ventilation throughout the whole. After drying in this way for six hours, the bundles were again collected into a stack, and a quantity of dry cashew leaves were mixed through the heap as before, being carefully covered with varagoo straw pressed down with weights. After remaining in this stack for two days, the bundles were again turned, and a fresh supply of *dry* cashew leaves were added, and the whole covered as before. This was repeated three other times at intervals of two days, when the tobacco was declared to be cured, though a little care was still said to be necessary to prevent over-heating. The tobacco thus manufactured was almost perfectly black and very sticky. It had an exceedingly strong

pungent smell, and it seemed to give every satisfaction to the manufacturer and to the natives to whom it was shown; however, it was perfectly useless as a tobacco for any European market, excepting, perhaps, for the manufacture of a sheep wash, or for any similar purpose, where a coarse, strong, pitchy-flavored tobacco is required. I referred before to this as the *quick* process; but I alluded to the fermentation heat employed rather than to the time occupied in the curing processes: such a violent fermentation is established that the structure of the leaf is altogether destroyed, while its tarry products are developed. I see nothing in these processes worth adopting: a result, equally as good, might be obtained in one-tenth of the time they occupied, with one-tenth of the labor they absorbed. There is a great amount of nonsensical mystery in the rules native tobacco curers obey. They limit each process to a certain length of time, without any reference whatever to the condition of the atmosphere at the time, whether moist or dry, whether hot, cold, or windy; neither do they make allowance for the manner in which the tobacco was grown, whether rapidly under irrigation, or more slowly under dry cultivation, or the amount of leaf fermented at one time, or, in short, the numerous other influences which affect all fermentative processes; but obey blindly a set of rules framed long before hygrometers and thermometers were invented, when no means existed whereby the different changes which take place during the different stages of fermentation could be ascertained. Good tobacco is, I believe, made under these empirical processes in some parts of the Presidency, but this, I think, only shows that the tobacco in these parts is naturally so good that these processes fail to injure it seriously. I believe that where tobacco is really good, that is, in districts where the soil provides the necessary plant-food, and in which the climate is in every way suitable, it is no more difficult to cure and prepare *good* tobacco for the market than in Ireland and some parts of England it is to cure clover hay or to prepare flax for the scutching mill. Practical men have certainly, in many parts of the world, discovered the process without the aid of any scientific information under which they can prepare a good marketable tobacco, but in every instance of the sort they have worked with a *naturally good* tobacco grown on a fertile soil in a district favored with a suitable climate. In many instances the whole of their processes are well known, but the rules they obey are of use only under conditions similar to those under which they originated. A process, which might in the West Indies produce most excellent tobacco, might altogether fail in this country, and, even in this Presideny, a set of rules, under which good tobacco might be prepared in the south-west and western portions of the Presidency, might be altogether misleading when adopted for a similar purpose on this side of India.

77. The remainder of the tobacco was cured in the following way:—On the plants being brought from the field, the leaves were immediately stripped off the stalks; after which they were strung on twine passed through the leaf stalk, the leaves being strung back and front alternately. Each string of leaves was about six feet in length, and was provided with a loop on either end, with which it could be suspended between parallel bars. These were hung in the open air and fully exposed for three days, being brought under cover at night. They were then hung up in sheds for about six weeks. By shutting or opening the windows of these sheds something could be done to regulate the in-door temperature, but during the hot dry weather of April, May, and June little real good could be done in this way. At the expiration of the six weeks, the leaves had become more or less elastic, while their color had changed from a yellowish green into a light brown. They were now taken down and were built, on the floor of the shed, in a rectangular stack, about three feet in height, paddy straw being placed under and over the stack, and the whole was heavily weighted. In this stack a gentle fermentation commenced, at first very slight, but gradually increasing in force. This was carefully watched, and whenever the heat became too great the stack was turned, the top strings of leaves being brought to the lower part of the stack, and the lower strings of leaves were brought to the top, while the outer strings of leaves were replaced by these which had formed the centre of the stack. In this way the whole of the tobacco was fully exposed to the influence of the fermentative heat. The leaves were kept for about three weeks in this stack, during which time they were turned, at least, half a dozen times, being always covered with straw heavily

weighted after each turning. The stack was next opened out, and the leaves were carefully removed from the strings, sorted, and tied in bundles of 25 each. The bundles were again stacked and the whole covered with straw as before. A slight fermentation was started, but not sufficient to injure the leaves. The stack was turned twice a month during the first two months. At the expiration of this period all fermentation had ceased, and the tobacco needed no further attention, a water-proof cover placed over being found quite sufficient to keep it in fair condition. The tobacco thus cured was certainly not a good article: many of the leaves, though elastic, were thin and papery, while the color was far from being uniform. Some leaves were a rich golden color, while others were a pale yellowish green. This, I think, was due to the exposure during the first three days. Had we had good open sheds in which to hang the tobacco when it was first removed from the field, the quality would have been better. The sun was so very hot during the days the tobacco was exposed, the outer leaves and the outer parts of the leaves were scorched and browned before the more sheltered leaves and parts of leaves had lost their green color, and I afterwards noticed that all the leaves and parts of leaves then scorched remained thin and papery, even after being submitted to fermentation. The color of the tobacco, though not uniform, was generally good, while the smell was mild and agreeable. Samples of this tobacco and of that cured by the country process were forwarded to Mr. Broughton, the Government Quinologist, for analysis and examination. The following is his report :—

MY DEAR MR. ROBERTSON,

I have tested the samples of tobacco (Manilla) cured by drying process and Dindigul country cured. The ash of the former contains but 0·6, and of the latter 0·67 per cent. of potassic carbonate. This is quite fatal to the quality of the tobacco, and I am quite of opinion that the soil of the neighbourhood of Madras can scarcely be made to produce tobacco of good quality. The former specimen is well grown and seems carefully cured. The nicotine has not been determined, as the data above given is conclusive. I should be glad to learn the mode of cultivation and subsequent treatment of the tobacco when convenient.

The tobacco resembles a good deal that which I received from the Agri-Horticultural Society of Madras, but is much better cured. The same care in another district would most probably produce a tobacco of good quality.

The above results are quite supported by the smoking of the tobacco.

OOTACAMUND,
February 15th, 1872.

Faithfully yours,
(Signed) J. BROUGHTON.

P.S.—I have no doubt but that the tobacco sent would be gladly smoked by natives, who generally care more for strength than flavor.

78. I agree with Mr. Broughton as to the improbability of our soils at Sydapet being made to yield good tobacco, excepting at a cost far in excess of the possible value of the tobacco produced. The following is an average analysis of the soil on which this tobacco was grown. It has already been published, but it is of such importance in connexion with the foregoing results that I venture to repeat it here :—

	Per cent.
Alumina	3·24
Oxide of iron	1·35
Phosphate of lime	·12
Carbonate of lime	·31
Sulphate of lime	trace only.
Carbonate of magnesia	trace only.
Chlorides	·90
Moisture	2·09
Organic matter	2·12
Sand	89·87
Total ...	100·00

For comparison with the above I quote from a report of the American Agricultural Department the analysis of a soil which produces good tobacco in the Maryland State :—

	Per cent.
Silica	82·56
Alumina	3·46
Lime	·31
Magnesia	·86
Potash	4·60
Soda	1·10
Peroxide of iron and manganese	3·36
Phosphoric acid	·50
Carbonic acid	·20
Ammonia	·08
Humic acid	·35
Carbonacious matter	2·55
Loss	·07
Total ...	100·00

These analyses are not determined in precisely the same way. The Experimental Farm soil was taken in its *natural* state, while the American soil was dried at 212 degrees before its constituents were determined. They are both *very* sandy soils; a glance at the two analyses will readily explain why the one soil is able to produce a really good tobacco, while the other altogether fails in doing this. The American soil is especially rich in *potash*, the mineral on which tobacco delights to feed; thus, it contains upwards of 4½ per cent. of this mineral, while the farm soils contain only a trace (determined with the chlorides). To make the farm soil as rich in potash as the American soil, it would be necessary to expend a sum in purchasing saltpetre or some similar manure, equal in amount to 20 times the value of the land manured. Now nothing would justify such an outlay, and, even if the saltpetre could be obtained *free of cost*, nothing would grow upon a soil dressed so heavily with *soluble* salts. Such a quantity of potash as would be needed could only be utilized when applied in some more *insoluble* form, as powdered felspar for instance; but of this such an *enormous* quantity would be required that it would of itself constitute quite a new soil. It is quite true that some soils with a much smaller percentage of potash than this American soil produce tobacco of a fair quality, but it is equally true that all the *best* tobacco lands contain a *large* percentage of potash. I have seen an analysis with as much as six per cent. of potash, though from three to four is the more usual percentage. Mr. Broughton found less than *half* a per cent. of carbonate of potash in the ashes of the tobacco our soils produced. For comparison with this result I am glad to be able to quote from the report before referred to the analysis of the ashes of the tobacco produced on the Maryland soil, of which I have already given the analysis :—

	Per cent.
Silica	2·40
Phosphoric acid	12·52
Lime	11·48
Potash	40·12
Soda	9·20
Magnesia	·80
Peroxide of iron and manganese	1·40
Chlorine	2·96
Carbonic acid	16·00
Sulphuric acid	2·04
Loss and unburnt carbon	1·08
Total ...	100·00

It will thus be seen that, while the ash of our tobacco *contained less than half a per cent.* of carbonate of potash, the ash of the American tobacco *contained upwards of* 50 *per cent.* Under these circumstances, it has been decided that it is useless to persevere in the attempt to grow a *good* tobacco on the soils of the Sydapet Farms. Abundant crops can be grown of such tobacco as suffices for the native market; but it is, as I have already shown, quite useless for exportation.

79. Though it has now been sufficiently well established that the ashes of a good tobacco must contain a considerable per cent. of carbonate of potash, it does not follow that a tobacco, whose ash is rich in potash, is necessarily a *good* one. Chemists, as well as tobacco growers, have much to learn regarding tobacco; indeed, Chemists are almost in entire ignorance regarding the proximate analysis of the juices of tobacco in the different stages of growth and during fermentation. We much need investigation into the changes that take place in the organic parts of the leaf during fermentation, in order that we may learn what we really must effect in order to manufacture a *good* tobacco; at present we are working in the dark. Some who have gone to work in this way have happily hit upon methods more or less successful and suited to their peculiar circumstances; but it is evident that if we are to do any real good in improving the tobacco of this country—a country in which the arable soils are in a more or less exhausted condition—*we must work on well-ascertained principles,* and unfortunately we yet know little or nothing of these principles. The whole subject needs a thorough investigation. Once ascertain what the changes that take place in the leaf during growth and during fermentation *really are,* and how these changes affect the *quality* of a tobacco, and it will become as easy to produce a guide for growing and curing tobacco as for brewing, cheese-making, malting, &c.

80. Recent investigations into the quality of the tobacco of this Presidency have most conclusively proved that soils which have long been under the exhausting system of cultivation usually pursued by ryots are, except where the soils are naturally *very* rich in plant food, quite unfitted for the production of a *good* tobacco, and that suitable tobacco soils must be sought for in thinly populated districts, where the natural fertility of the soil has not yet been permanently injured.

81. *Advantages of early harvesting Crops.*—The importance of harvesting crops *before* they are *dead* ripe seems not to be appreciated in this country. The following experiment may be instructive:—A small plot of car paddy, containing 388 square yards, was divided into two equal parts—one-half was harvested when the grain on being pressed between the finger and thumb ceased to exude any milky fluid, though the straw at the time was quite green; the other half was allowed to stand until *dead* ripe, as is the usual practice of the ryot. The first half was cut on the 13th June, and the remaining half on the 3rd of July. The following are the results:—

——	Square Yards.	Produce per Plot.		Produce per Acre.	
		Grain. lbs.	Straw. lbs.	Grain. lbs.	Straw. lbs.
Plot No. 1...	194	56	245	1,397	6,112
Plot No. 2...	194	42	170	1,047	4,241

Thus, the half of the plot early harvested produced per acre 350 pounds more of grain and 1,871 pounds more of straw than the half that was allowed to stand until it was *dead* ripe. Any one conversant with the appearance of paddy land a few weeks after harvest will readily account for this loss of 350 pounds of grain. It is chiefly shed on the ground, though a certain proportion is carried off by birds. The difference in the weight of the straw is due to the larger quantity of juice it contained when cut green, and, as at this stage in the growth of the plant its juice contains a large percentage of nutritive matters, this increased weight is so much gain; besides a ton of straw cut when *dead* ripe does not contain so much nutritive matter as a ton cut two or three weeks before it has reached this stage. The results of this experiment fully agree with my experience in England and in Ireland; however, next

season I will repeat the experiment on a large scale on a great variety of crops, though I am so far satisfied that I shall adopt the practice of *early* harvesting to a much greater extent than I have in former seasons.

Manure.

82. A large number of experiments were made with manures of various kinds; but the general results, owing to the very unfavorable character of the season, were most unsatisfactory, especially so in the case of saline manures used as top dressings; these, from their extreme solubility, could not be applied to the cold weather crops (the chief crops of the year) until after the cessation of the north-east monsoon, and unfortunately afterwards, while the crops remained on the ground, the total fall of rain was only *one* inch. The top dressings, therefore, in most instances remained in the soil in a more or less *inert* condition, almost useless to growing crops, only being active in a few instances where the soils, from their more retentive character, contained more moisture.

From these circumstances, the results of a very large proportion of the experiments made last season cannot be reported, and many of these I shall place on record here need to be again repeated before the results arrived at can be accepted as at all decisive. But, before noticing these experiments in detail, I will briefly refer to the different manures used.

83. *Farmyard Manure.*—This manure was made in our cattle boxes under cover, protected alike from sun and rain. It consists of straw used in bedding, and the excrementitious matters of the cattle, which being allowed to accumulate in the boxes during two or three months, layer by layer, and being constantly subjected to the pressure of the animals' feet, becomes a rich homogeneous mass of a dark brown color, fitted at once for use, without undergoing any preparatory process. As the cattle stalled in these boxes are all fed, in addition to green fodder, on oil-cake, the manure is necessarily *rich* in the more important elements of plant food, phosphoric acid, ammonia, potash, &c., as fully *two-thirds* of these constituents of the oil cake pass into the manure. We find that in an average year we obtain 20 cart-loads of this manure for *each* working bullock housed in these boxes; and this is only the manure made at night and during a portion of the day when the cattle are not engaged in field labor; thus, *for every pair of working cattle we employ we can calculate on obtaining* 40 *cart-loads per annum* of farmyard manure, or, as it should more strictly be called, box-manure. The manure generally known as farm yard is not nearly so rich, being not unfrequently made in open yards exposed to the weather by young stock eating straw and other innutritious food. We now use this manure *direct* from the cattle-boxes; formerly I had it carefully stacked in pits in the different fields in which it would be needed, but I was obliged to give this up, as the manure in a dry season suffered so much, not perhaps by any diminution in its fertilizing ingredients, but in its physical properties, for it must be remembered that the beneficial results attending the use of farmyard manure are due to no inconsiderable extent, to its physical action on the soil, as well as to its power of yielding to the soil the exact chemical food needed for the production of crops. The most effective way to preserve the manure in the field is to stack it layer by layer in pits, consolidating it thoroughly at the time, by causing the laden carts to pass over, and finally covering the whole with thick layers of ashes and loamy earth. Heaps thus prepared were found, at the end of two or three months, to have diminished to about one-tenth of their former bulk, the manure having become a dry dusty substance, certainly much more portable and less costly to distribute, but quite destitute of the valuable physical properties of farm yard manure. One or two heaps through which the blood refuse from the slaughter-house had been poured were in a much better condition, but even in these the manure was not in a satisfactory state. As storing the manure in the field in which it will be needed *saves time* during an *urgent* seed time, and employs the cattle and laborers during the dry weather when work is less pressing, it might in some instances be worthwhile to erect temporary palmyra leaf roofs over the heaps, or to thatch them with straw or grass in districts where the white-ants are not so troublesome as with us, or the heaps might be kept in a naturally moist state by the occasional application of either water or

urine; but I fear that this could not be managed effectually, unless with regularly-built manure pits, through which the water would not pass, as such a quantity of liquid would be needed to counteract the effects of the great evaporation that the frequent washing would *remove* all the more soluble constituents of the manure. Another, though a lesser drawback to storing manure for use in the field, is the attraction these heaps afford to snakes, scorpions, and other vermin.

84. Before proceeding to notice other manures used on these farms, I would briefly point out the benefit the ryot would derive from his adopting the loose-box system in housing his cattle in the *large* quantity of *good* manure he would obtain. It is true that he must incur some expense at starting, but this need not be much. He can with his own labor erect sheds, the materials for which need not cost him 5 rupees per head for all the cattle he provides with shed room; and this expenditure he would, in many instances, recover in a single year. As I have before stated, *we obtain* 40 *loads of manure per annum from each pair of working cattle* we employ, but our cattle are larger than those generally employed by the ryot; for this we may deduct one-fourth, which still leaves 30 *cart-loads* as the quantity the ryot may expect for *each pair of cattle* he stalls at night in these boxes. On a ryot's holding consisting of 30 acres of arable land, there is generally at least two pairs of working cattle, one or two milk cows or buffaloes, as many young cattle, and two or three goats or sheep. If all these animals were confined at night in loose boxes properly littered with leaves, straw, &c., the ryot would in the year obtain at the least 100 *cart-loads of good manure,* sufficient to manure well one-third of his farm in each year or the whole once in every three years. Of course, the animals would need a good deal of bedding, but this, which may consist of leaves, stubble, refuse straw, coarse grass, reeds or rushes from jungles, sides of tanks, and water courses, &c., with a portion of peaty earth, ashes, saw dust, burnt earth, or even sand, can readily be procured in most districts. It would not be absolutely necessary that the food usually given to the animals should be changed, but the results would certainly be far more satisfactory if, instead of as at present, for a few months after harvest, giving so much dry straw, a portion, say one-half, was replaced by green fodder. The dry fodder could in this way be husbanded and made to serve *throughout* the year. By the time dry fodder is *really necessary* for the live stock of the ryot, that is, during and after the rains, *there is frequently not a bundle of straw left on his premises,* and he has no alternative but to allow his stock to feed exclusively on the rank, hastily-grown grass then abundant, which predisposes them to attack by the various forms of disease that at such seasons commit such havoc amongst the flocks and herds of the ryot. The cost of producing the green fodder is not worth a moment's thought; *to the ryot it will be so trifling.* I have shown over and over again that *we* can on these farms with hired labor produce any quantity at about 3 rupees per ton, and the ryot with his own labor could produce it at a much less cost. In the saving in live stock alone the cost of green fodder would be more than repaid, without any allowance whatever for the superior quality of the manure made by cattle partly fed on such fodder.

85. *Slaughter-house Refuse.*—We obtain for manure the refuse of the Commissariat slaughter-yards which are situated on the Experimental Farm. This consists of blood, the more solid matters, and a considerable quantity of yard washings. The whole is removed daily to compost heaps. These are formed of ashes, burnt earth, weeds and other vegetable refuse, and the blood, &c., is poured over, the heap being covered each time with ashes to prevent any offensive smell being given off. These compost heaps are placed in hollows excavated for the purpose, made to hold from 50 to 80 loads. After the proper height has been reached, generally from four to five feet, the whole is allowed to stand for two or three months, and then when opened the manure is found to be in the best possible condition for immediate use, having quite lost all its former unpleasant properties, and assumed a condition in which it is impossible to determine of what it was originally composed. In this state even our caste coolies make no objection to work amongst it. The manure thus prepared is very valuable for all kinds of crops, especially for such crops as sugar-cane, maize, &c., which require highly nitrogenous manures. For grass and fodder crops it is

also of great value. It possesses this advantage over farm yard manure that it can be used in the dry season without in any way increasing the bad effects of a long drought. Farm-yard manure applied at such a time renders the soil more liable to suffer, though this very propensity makes farmyard manure especially valuable during the rains and at other seasons of the year when a thorough aëration of the soil is of the utmost importance.

86. *Animal Charcoal.*—A quantity of animal charcoal was kindly supplied by Messrs. Arbuthnot & Co., the only cost incurred being a small sum for freight to Madras. It is the refuse charcoal of their sugar refineries. It reached us in very fine condition, in a dry powdery state, fit for immediate application to the soil. No analysis was made of this sample of charcoal; however, excepting in the quantity of moisture they contain, pure samples differ very little in composition, and the sample experimented with was in a good physical state, and apparently in every way a good average specimen of this refuse. This manure owes its special value to the phosphate of lime it contains.

87. *Cotton-seed Manure.*—This was simply cotton seed which had been steeped in urine or water to destroy its vitality. It is undoubtedly one of the best manures we possess, and is suited for any crop we grow, more especially the cotton crop. In cotton seed we have a large quantity of fertilizing matter concentrated in a very little bulk. It is thus well suited for coffee or tea planters, and where, in order to reduce the cost of transit, it is necessary to get a *portable concentrated manure.* Cotton seed is used to some extent as a cattle food; but it is not a *safe* food to give, except in *very* small quantities and along with succulent food, as the cotton, which invariably adheres to the seed, sometimes collects in balls in the stomach, and produces serious and often fatal disarrangement in the digestive organs. I have seen balls of this sort with a circumference of from seven to eight inches, which have been taken out of the stomachs of animals thus killed. Cotton seed, however, makes a valuable oil-cake for feeding purposes *when it has been decorticated* and the outer covering with the adherent cotton has been removed. It is thus manufactured for the purpose of extracting the oil which is purer and more valuable when extracted from the decorticated seed than from the whole seed; but expensive machinery is required, and the oil cannot be produced at a cost sufficiently low to enable it to compete successfully with other oils. Under these circumstances, though at first sight it may appear rather a wasteful practice to use cotton seed as a manure, especially as the oil it contains, though valuable in feeding is worthless as manure, it is nevertheless a practice to be recommended until some cheap and effective means of removing the outer husk of the seed has been discovered.

88. *Sulphate of Lime.*—This is the refuse of the soda water manufactories in this district. Manufacturers place no value on it, and allow it to be removed free of cost as it accumulates and becomes a nuisance in the neighbourhood of their premises. It is not chemically pure sulphate of lime. It contains besides carbonate of lime various chlorides and sulphates and sulphurets of calcium and sodium; but on this account it is none the less valuable as a manure, while to us near Madras it is *far less costly* than *natural* sulphate of lime. Our soils being very poor in lime, this manure is of great value to them, but its special value is as manure for leguminous crops. As a constituent of compost heaps containing decomposing nitrogenised matters, it is of special value in arresting the escape of volatile ammonia, the sulphuric acid it contains having evidently a stronger affinity for ammonia than for the lime with which it is in combination.

89. *Carbonate of Lime.*—We obtain this in the form of burnt shells (marine and fresh water), such as are used for preparing shell chunam in the Madras District. They yield an almost pure carbonate of lime, containing an exceedingly small quantity of impurities. After being slacked it forms a light powder, which can, with great facility, be spread over the land. But at the rate prevalent in Madras this is a *costly* way of obtaining lime for agricultural purposes. *The cost is at least* 50 *per cent. in excess of the cost of equally good lime in the agricultural districts at home.* There is little prospect of much lime being used in agriculture here until it can be supplied at one-fourth its present price, and there is no reason why this should not eventually be the case, at any rate in those fortunate districts in which lime abounds, if, the present rumour of the discovery of the coal formations in one or two districts

of this Presidency turns out to be correct, as coal can be conveyed long distances by rail at a very low rate ; and if it is too inferior for raising steam or for similar purposes, it may answer well enough for burning limestone. But near large towns with considerable accumulations of organic refuse, consisting of sweepings, &c., there appears to be no reason why limestone should not be burnt for agricultural purposes at a very *low* cost, as *these accumulations would provide excellent fuel for the purpose*, while the ashes made would of themselves make a valuable manure. Nodular limestone can in most instances be obtained at very easy distances, the position of the town of Madras being especially favorable in this respect.

90. *Bone dust.*—This is minutely pulverised bones; so prepared in order to facilitate distribution over the surface of the ground. This minute state of division is not generally necessary, and the dishonest dealer can, with so much more ease, adulterate bone dust than he can adulterate bones which are simply broken ; while for all practical purposes the quarter or half inch bone is equally as effective, not perhaps in the *immediate result*, but in the *general effect.* All the different preparations of bones are valuable to the farmer, whether as boiled bones, crushed bones, bone dust, bone black, or in the form of superphosphate, chiefly in yielding phosphate of lime, though in the *raw state* bones yield a large percentage of ammonia, still it is as a means of adding phosphateof lime to the soil that they are chiefly employed by the farmer, as it is phosphoric acid and phosphate of lime that all cultivated crops appropriate so largely, and not only crops, for every animal the farmer rears removes from the soil large quantities of phosphate of lime in building up its internal framework of bones, muscles, &c. Assuming that the bones of an average sized country bullock weigh 80 pounds containing 55 per cent. of phosphate of lime, and an average sized sheep or goat 15 pounds of bones, containing a similar percentage, it is not difficult to explain in what way the soils of the ryot, on which stock are reared, fast become exhausted in phosphates or bone material. Bones are costly in this part of India, but there seems little probability of them becoming cheaper, as their use is becoming much more general, especially amongst the tea and coffee planters on the hills. Our only hope of obtaining phosphatic materials at a fair price, that is, at a price fairly proportioned to the low value of our agricultural produce, is in the discovery of phosphatic rocks, or coprelites, in accessible parts of our own Presidency. It is unfortunate that, as yet, no phosphatic rocks or coprelites have been discovered in any quantity in this part of India. There cannot, I think, be any doubt but that they do exist, and in sufficient quantity. The fact that coprelites have not yet been discovered in this Presidency, except in very small quantities in the Trichinopoly Collectorate, is no proof that they do not exist, for it is, comparatively speaking, but recently that coprelites have been discovered in certain parts of England, though its surface has for years been mined and excavated in every direction, and even now we are constantly hearing of the discovery of coal, salt, gypsum, and other valuable deposits in districts and under formations where their presence was never even suspected. Probably, if some inducements in the shape of rewards were offered for discoveries of valuable deposits of mineral manures, engineers and railway and road contractors, who are conducting excavations in so many different parts of the Presidency, and who must often meet with indications of the presence of valuable deposits, might find it worth while to follow up these indications.

91. *Saltpetre.*—The saltpetre used last season was some that had been rejected in the Gunpowder Factory at Madras. It was not so pure as that used in the previous season. It contained only about 75 per cent. of nitrate of potash, the remainder of the sample being composed of chlorides, moisture, sand, and other impurities. It was supplied in Madras at the rate of Rupees 25 per candy of 500 lbs. The results obtained with saltpetre last season were not nearly so good as those obtained in the previous year. To obtain the best results from saltpetre, it must be applied during showery weather to a loamy soil, which contains a fair percentage of organic matter, or which has been well manured with a manure containing a fair proportion of organic matter. On some of our very sandy soils saltpetre last season produced no effect whatever, though, to a great extent, this was due to the long drought which followed

its application to the soil; still had the soils contained a fair proportion of organic matter, there is no doubt but that the result of the dressings would have been more satisfactory, as some fair results were obtained with saltpetre on soils manured with vegetable manure. The action of the organic matter here must, I think, be attributed to its hygroscopic powers in attracting and retaining moisture. There is, however, as yet much uncertainty as to the action of decomposing organic matters on purely mineral manures. By some it is supposed that they act the part of ferments or digesters, and render the mineral matter more easily assimilated by the growing plant. Doubtless to some extent this is true, for in the various forms that organic acids assume it is just possible that they may in the soil at times produce this effect; for it is quite certain that the collective effect of a dressing of organic manure and of a mineral manure is much greater than the collective effect of the same quantity of each of these varieties of manure when used separately. The practical conclusion then is, that saltpetre is most effective as a manure when employed on soils already in good manural condition, or when used as an auxiliary manure along with some organic manure. In many parts of the Presidency saltpetre can be obtained on very reasonable terms. It is not necessary to use the refined samples. The ordinary crude saltpetre is sufficiently good, provided that it *is obtained at a price having some relation to the quantity of pure nitre it contains.*

92. *Peruvian guano.*—This guano had been in stock at the farm for several years, and had lost most of its ammonia; in other respects it was in good order.

93. *Oil cake.*—The variety of cake used is known in Mysore, where it is chiefly produced, as "Ippa" cake; in Madras it is called "Ilpa" cake. The seed from which it is manufactured grows on a large shrub, or small tree, the botanical name of which I have not yet been able to ascertain. The oil which is extracted is highly valued by Hindus, and is much used in their religious ceremonies. A small lot of this cake, weighing 3,002 pounds, was purchased in Bangalore for 8 rupees, or at the rate of about 15 maunds per one rupee, the rate then current; but unfortunately the railway carriage on this lot to Madras amounted to Rupees 15, thus *adding nearly* 200 *per cent. to its first cost*, and almost prohibiting its employment as a manure in this district. This is particularly to be regretted, as of all the manures we used last season, it produced the most satisfactory results, and it can, I believe, be obtained in sufficient quantity in Bangalore.

94. The railway charge, Rupees 13-10-1 per ton, for conveying manure cake a distance of only 216 miles is *exceedingly* high, and is even in excess of the rates charged in England, though in that country agricultural produce of all kinds is *twice as valuable.* In proof of this I quote below the rates charged by the North-Eastern Railway Company, whose circumstances are in no way exceptional for conveying manure cakes and artificial manures over their lines :—

		Rate per ton in lots of two tons and upwards.		
	Miles.	£.	s.	d.
From Newcastle to Birmingham	214	1	0	0
Do. to Leeds	100	0	10	0
Do. to York	84	0	11	8
Do. to Carlisle	66	0	10	10
Do. to Berwick	66	0	8	10
Do. to Darlington	39	0	5	10
Total ..	569	3	7	2

or for conveying one ton of manure for a distance of 100 miles 11*s.* 9½*d.* With none of these towns, excepting Berwick, is there any sea carriage to compete with, so that these rates are in every respect fair examples. From the rates charged on the Madras Railway I quote the following :—

	Miles.	Rate per ton in lots of less than six tons. Rs.	As.	P.
Madras to Coimbatore	301	18	0	4
Do. to Bangalore	216	13	10	1
Do. to Jollarpet	132	8	4	0
Do. to Arcot	65	3	6	7
Do. to Arconum	42	2	11	3
Total ...	756	46	0	3

or for conveying one ton of manure cake 100 miles Rupees 6-1-4.

95. The following are a few only of the experiments made :—

A portion of a field planted in alternate lines with New Orleans cotton and maize was top-dressed in the latter part of the first week in October, the crop at the time being only a few inches above ground. The land set apart for these experiments was divided into 16 plots, each containing one-twelfth of an acre. The experiments were repeated in duplicate The whole of the land was manured before the crop was sown with farmyard manure at the rate of 20 cart-loads, or about eight tons per acre. The following results are the averages of each pair of experimental plots, excepting the results from the pairs 7 and 14, which in the column for cobs and straw is the result of plot 14 only : that of 7 not having been correctly stated in our field memorandum cannot be recorded here ; but the yield of cotton is the average of the *pair* of plots, as in the other instances.

No. of Plot.	Top-dressing applied.	Average Yield per Plot. Cotton in Seed.	Maize. Cobs.	Straw.
		lbs.	lbs.	lbs.
7–15	Not top-dressed	50–5	94	206
1–9	Guano, 20 lbs.	52·5	179	415
2–10	Saltpetre, 30 „	55·5	147·5	365
3–11	Bone dust, 50 „	52·3	161·5	345
4–12	Animal charcoal, 50 „	56·1	126	244
5–13	Sulphate of lime, 228 „	52 5	122	270
6–14	Ilpa oil-cake, 200 „	60	177	315
8–16	Carbonate of lime, 228 „	53·6	124·5	299
	Add yield of duplicate (top-dressed) plots	382·5	1037·5	2,250
	Total yield of 14 top-dressed plots measuring together 5,600 square yards	765·0	2075·0	4,500
	Yield, per acre, of top-dressed land	661·1	1793·3	3,889
	Yield, per acre, of undressed land	611·5	1134·9	2,492
	Increase, per acre, due to top-dressings	49·6	558·4	1,397

The value of the top-dressings applied was about 18 rupees per acre, while the increase per acre they have yielded so far is worth 15 rupees, so that only five-sixths of the cost of these dressings has as yet been recovered; however, as the cotton plants will be treated as biennials and be kept for *another* crop, we will in the ensuing season recover the value of the fertilizing effect of the dressings yet available, as no more manure will be used. Still even now the *general* result of the experiments, from a commercial point of view, are most satisfactory ; the whole of the expenses, including all cultivations, farmyard manure, top-dressings, gathering, cleaning, &c., have not only been repaid, but a good balance is left ; but, as I have discussed these matters fully under head "Cotton," I need not dwell longer on them here. I would now draw attention to the following table, which shows the average produce per acre of the different experimental plots, with the quantity of manure used per acre in producing the results :—

Manure and Top-dressing per Acre.	Yield per Acre.		
	Cotton in Seed.	Maize.	
		Cobs.	Straw.
8 tons of farmyard manure only	611·5	1134·9	2,492
8 do. do. and 242 lbs. guano	635·2	2165·9	5,021
8 do. do. and 363 „ saltpetre	671·5	1784	4,384
8 do. do. and 605 „ bone dust	632·8	1954·6	4,180
8 do. do. and 605 „ animal charcoal ...	678·8	1524·6	2,968
8 do. do. and 2,758 „ sulphate of lime ...	635·5	1476·6	3,280
8 do. do. and 2,420 „ ilpa oil-cake	726	2141·9	3,820
8 do. do. and 2,758 „ carbonate of lime ...	648·5	1506·4	3,628

96. A portion of a field planted with maize and Hinginghaut cotton in alternate rows was divided into four plots, each containing 2,500 square yards. One plot was dressed with carbonate of lime, another with sulphate of lime, another with animal charcoal, and the other was not top-dressed. In the following calculations I have deducted one-half of the area of each plot for the cotton crop which occupied each alternate row, and have on the same account made a similar deduction in the quantity of the top-dressings used:—

No. of Plot.	Top-dressing applied.	Produce.			
		Per Plot.		Per Acre.	
		Cobs.	Straw.	Cobs.	Straw.
		lbs.	lbs.	lbs.	lbs.
3	Not top-dressed	150	588	580·4	2,276
1	Carbonate of lime, 500 lbs.	219	1,008	847·9	3,902
2	Animal charcoal, 250 „	160	806	619·5	3,120
4	Sulphate of lime, 500 „	178	724	689·2	2,803

Before the top-dressings were applied, the whole of the land was manured with farmyard manure, at the rate of about eight tons per acre. It will be seen that a dressing of carbonate of lime at the rate of 1,936 lbs. per acre produced 267·5 lbs. of cobs, and 1,617 lbs. of straw per acre more than the plot simply manured with farmyard manure. In this instance the cost of lime was repaid by the crop to which it was applied, while there is not the least doubt but that the beneficial effects of this dressing of lime will be seen for several years on the crops grown on this land. In these experiments the sulphate of lime was not so effective as the carbonate of lime, though it is a well known fact that this manure is of especial value as a manure for the maize crop; probably, the superior efficacy of the carbonate over the sulphate in this instance may be due to the action of carbonate of lime on such a soil (a stiffish one in a sour condition) as that on which these experiments were conducted in restoring the healthy alkaline condition and in rendering the insoluble silicates soluble and fit for assimilation by the growing crops. I cannot account for the inefficiency of the charcoal in these experiments.

97. The next experiments were made on a field of yellow cholum (Holcus Sorghum), one-half of which was set aside for the experiments. This was divided in eight plots, each containing 1,000 square yards. Each experiment was repeated in duplicate. The yield of each pair of plots is given below:—

No. of Plots.	Top-dressing applied.	Produce.			
		Per Plot.		Per Acre.	
		Grain.	Straw.	Grain.	Straw.
		lbs.	lbs.	lbs.	lbs.
3 + 7	Unmanured	76	1,442	183·9	3,489
1 + 5	Carbonate of lime, 360 lbs. ...	90	1,487	217·8	3,598
2 + 6	Saltpetre, 50 lbs. ...	131	1,633	317·0	3,951
4 + 8	Sulphate of lime, 360 lbs. ...	97	1,435	234·7	3,472

The soil on which these experiments were conducted is stiffer than the majority of our soils. The top-dressings were applied about the end of the second week in October, and, though, doubtless, a large proportion of the more soluble portions were washed off the land by the heavy rains which fell about that time, the results are more satisfactory than the results of the top-dressings applied ten days later, when the *heavy* rains had ceased. The two plots dressed with saltpetre produced nearly twice as much grain as the two plots of similar size that were not manured, while they also produced nearly one-fourth of a ton more straw; as the cost of the saltpetre applied was *under 5 rupees per acre*, it was more than recovered in the increase obtained. The increase from the limes was not quite equal to the cost of the applications; but this was scarcely to be expected, as the action of lime is much slower, though more durable than the more active saline manures. The benefit from saltpetre must be obtained during the year in which it is applied, or at the outside, in very dry seasons within the second year, whereas lime may act and give good results for nearly ten years.

98. A portion of a field sown with tennay (Panicum Italicum) was set aside for a top-dressing experiment. Each plot contained about one-sixth of an acre. The dressings were all applied on the same day in the last week in October. The crop was at the time several inches in height.

The following are the results:—

No. of Plots.	Top-dressing applied.	Produce.			
		Per Plot.		Per Acre.	
		Grain.	Straw.	Grain.	Straw.
		lbs.	lbs.	lbs.	lbs.
1	Unmanured	6	96	36	576
2	Animal charcoal 90 lbs. ...	9	137	54	822
3	Guano 26 lbs.	11	90	66	540
4	Bone dust 90 lbs.	20	112	120	672
5	Saltpetre 40 lbs.	18	132	108	792

The crop, owing to the drought, was almost an entire failure. In none of the experiments was the cost of the manures repaid, though, in two instances, *the top-dressings nearly trebled the yield of grain.* The drought was especially severe on this crop, as the soil on which the experiments were conducted is very light, containing upwards of 90 per cent. of sand.

99. A small field, also sown with tennay, containing 7,000 square yards, was divided in two equal parts; one-half was dressed with 400 pounds of animal charcoal, and the other half was not manured. The dressing was applied during the last week in October, the crop being at the time several inches high. The results were—

No. of Plots.	Top-dressing applied.	Produce.			
		Per Plot.		Per Acre.	
		Grain.	Straw.	Grain.	Straw.
		lbs.	lbs.	lbs.	lbs.
1	Unmanured	40	344	55·3	475
2	Animal charcoal 400 lbs. ...	77	375	106·4	518

These experiments were conducted on a similar soil to that on which the last-quoted experiments were conducted, and like them they are very unsatisfactory.

Implements, Machines, &c.

100. In former reports I have referred to the different machines, implements, &c., in general use on the Madras Farms. In the observations I am about to make I shall

refer chiefly to machines, &c., recently introduced, to improvements effected during the past 12 months in the machines, &c., previously in use, and to machines, &c., recently brought into more general use.

101. *The combined plough.*—The combined plough, referred to in paragraph 210 of my last report, has been very much improved during the past 12 months. A land wheel has been substituted for the slade formerly used, and this has not only greatly reduced the draught, but it has also made the plough much more portable; and a frame with cultivating tines has been made to fit the body of the plough, enabling it to be employed either as a cultivator, or as a plough; for cultivating, it being only necessary to remove the mould board and fix on the cultivating frame. The necessity of employing two distinct implements for cultivating and for ploughing is thus removed, while the cost of the combined implement is only half the cost of the two separate implements.

102. The substitution of the wheel for the slade was suggested by a native blacksmith, who, with other blacksmiths, had been brought to the Experimental Farm by the members of the Madras Hindu Club, and invited to inspect the implements, &c., in use, with the view of ascertaining what improvements could be effected in the construction of implements used by ryots, their ingenuity being especially stimulated by the offer of a reward of 50 rupees by the Farm Committee for any improvement in the make of ploughs calculated to render them more useful in Indian agriculture.

103. I have not yet had an opportunity of testing with the dynanometer the actual difference in the draught of ploughs fitted with a wheel and with a slade only, but in light free soils it must be very considerable; for, instead of the dead weight of the plough being supported on a slade drawn along over the floor of the open furrow, it is now carried over on a wheel. On stiff adhesive soils the advantage will *not* be so great, as the wheel on such soils is very liable to clog, and for wet land cultivation, after the land has been puddled, it is altogether unsuited: for such work the slade is preferable to the wheel. The wheel has greatly increased the facility with which the plough can be transported over the farm. It can now be moved about almost as easily as a wheel-barrow whereas before this improvement was made it was necessary that it should be *carried* to and from the field. The cultivator which is attached to the plough is useful for working the land between the rows of growing crops. It can perform work of this kind at a cost 50 per cent. below the cost of similar work performed by manual labor.

104. *Turnwrest pony ploughs.*—One of these ingenious little ploughs was obtained from England. It has been employed as a cultivating plough amongst cotton, maize, &c. It performed this work in a very satisfactory manner. The draught is *very* light. Turnwrest ploughs are intended for use on slopes of hills, on which it is desirable to throw off the furrow slice on *one side only*: for this purpose the mould board is reversable; still for use as ordinary ploughs for cultivating, &c., they are well suited, and possess this advantage over the plough of the ordinary make that, when the mould board is worn near the sole, it can be reversed, and the upper portion brought into use, thus performing the part of a new mould board. These ploughs are made entirely of iron, and are well suited for coffee or tea plantations, where the slopes are not *too* great. They can be worked with a single bullock, pony, or mule, thus avoiding the use of swingletrees, which do so much damage amongst tea and coffee bushes. These ploughs can be offered at a much lower price than ordinary iron ploughs; so much less iron is used in making them.

105. *Wooden drag harrows.*—Useful drag harrows for cleaning dirty land have been made up in our workshops at from 15 to 20 rupees each. They perform very good work, and can be made up and repaired wherever there is a village smith. We have made them to expand or contract, to fit them for any sort of work.

106. *Seed barrow drill.*—A seed drill was constructed out of an old broadcast seed barrow. It is fitted inside the hopper with rotary brushes fixed on an axle driven from the wheel. These throw the grain into the seed coulters, which are composed of loose tin funnels fitted into each other, as in the seed coulters of Garret's drill. The barrow has two seed coulters, but three can be used if necessary. The distance apart of the seed

coulters can be regulated at pleasure to sow in lines from 9 inches up to 24 inches apart, and by altering the gearing the speed of the elevating brushes can be increased or decreased, so as to sow a large or a small quantity of seed. This drill will sow all the usual grains and pulses, raggy, cholum, tennay, shamay, varagoo, gingelly, cumboo, the grams, &c. With it three men on such soils as ours will easily sow about two acres per day. We make up drills of this sort at Rupees 30 each—a moderate price when it is considered what sort of work they can perform. We have made up ordinary country bamboo drills, the cost of which was not more than one-tenth of the cost of the barrow drills, but the work performed by them is very indifferent, besides where a number of different crops are grown, requiring to be sown in lines at varying distances apart, a *separate* drill is *required for each* as the seed coulters are fixed, and will only sow at *one* width; again the country bamboo drill does not sow to a regular depth, and the quantity of seeds it sows per acre altogether depends on the skill or watchfulness of the man who attends it. *There is no guarantee of regularity.* He may sow one part of the field at the rate of 50 lbs. per acre, another part at 30 lbs., and on other parts he may altogether omit sowing the seed. It is quite true that many ryots do excellent work with these *very* primitive implements; but then *the ryot himself* drops the seed into the seed coulters, he is not generally dependent on *hired* laborers, whose interest in the work is confined to getting over the land as *speedily* as possible. It is a *serious* matter to have land badly seeded, as the defect cannot be discovered until the crop appears above ground, when, owing to many circumstances unnecessary to detail here, it is frequently impossible to remedy matters; the only choice being either to plough and sow again, or to leave the crop with large blanks, in which weeds will grow and give endless trouble. There can be no doubt but that, on any holding on which 30 acres of dry crops are sown annually, the cost of a good seed drill will be more than repaid during *each* year in which it is used. I am not here advocating the employment of large complicated drills, such as are used in England and other countries, where labor is costly, but such drills as I have already described that can be made at from 25 to 30 rupees each. There is a class of *superficial* reasoners always ready to oppose the introduction of any improved implements or machines, if only these machines are more costly than those already used by ryots, altogether regardless of their *superior efficacy* over those in use. To such I would point out what every thinking man must at once admit that, if a drill, costing 30 rupees, *will in a year return on* 30 *acres of crop one rupee per acre in excess of the amount a similar area of crop sown by the ordinary drill would yield*, it must be to the ryot a much more desirable machine to possess than the one he already owns, though this may have cost him only one-tenth of the sum that he would pay for an improved drill.

107. *Hand wheel hoes.*—A few of these wheel hoes have been made and used, but the general results have not been very encouraging. They were made both with pronged hoes and broad hoes; but neither did the work as well as ordinary hoes, while they cannot work as cheaply as those drawn by cattle. One or two have been supplied to tea plantations, but I have not heard how they answered; for hoeing on the slopes of hills, I should suppose, they are well suited. It is work in which they have not to compete with cattle hoes; while in forcing the hoe down or obliquely across the slopes, it can be pushed with much greater force than over level surfaces.

108. *Plantation hoes.*—Specimens of the different descriptions of hoes used by planters were obtained, and a number of each sort were made up for use on our farms. They were used with great advantage during the past dry season, and could be employed at times when our *light* broad hoes failed to bite the ground, when, of course, the advantage of using hoes is especially great in killing weeds and in increasing the absorbtive powers of the soil.

109. *Threshing machines.*—We have three of these machines in store here, all by good makers; but we seldom use them, as they are not suited for the general agricultural crops of this district. Paddy and raggy are the only crops we grow that these machines thresh well. Cholum and cumboo can also be threshed by them in a more or less satisfactory manner when the straw has been cut in lengths of above one foot; but this is troublesome

and costly to do, as the crop must be harvested in *two* operations, first, the head with the foot of straw, and afterwards the remainder of the straw. It is quite impossible to pass through the drum (as is always done in threshing English crops) the unthreshed straw of such crops, as cholum, cumboo, &c., which is generally over five feet, and sometimes over six or seven feet in length, with a circumference of three or four inches. If the waste of time is of *little* moment, we have no machine strong enough for such work. None of our other crops can be threshed in a satisfactory manner by these machines. In some cases the straw is *so weak* it winds around the drum, and in others the grain is so small and so tightly enveloped in the husk (shamay, tennay, varagoo, &c.,) that the beaters have little or no effect, and leave more than three-fourths of the grain in the straw. The fact is, our English threshing machines are made *to thresh special crops*, those grown by the British farmer: thus, out of the 12 millions acres of land annually under grain and pulse crops in the United Kingdom, the crops (wheat, barley, and oats) these machines were *specially invented to thresh occupy* 10½ *million acres, or* 93 *per cent. of the whole.* The ryot, on the other hand, grows a *great* variety of crops, scarcely any two of which bear such a resemblance to each other, as do the cereal crops of the British farmer. Paddy, wheat, and raggy are the only crops grown in this Presidency that these machines thresh in a satisfactory manner, and these only occupy about 6½ millions acres (under 33 per cent.) of the 20 million acres annually under cereal and leguminous crops in the Presidency, and in threshing these the ryot can, in many instances, thresh cheaper by the flail than he could if using a machine. An ordinary cooly, whose wages would be 4½ pence per day, can readily thresh with a flail six bushels of paddy in an ordinary working day, the cost of threshing being thus *only six pence per quarter, and this could not be done at a less cost by any threshing machine yet invented.* I see little chance of threshing machines coming into general use in this country *as long as three men can be hired to perform a day's work for one shilling*, or until a threshing machine is invented specially suited for threshing the *many* different crops grown by the ryot.

110. *Winnowing machines.*—These machines are in very frequent use on both farms. The whole of the different grains, pulses, and oil seeds grown in Southern India can be cleaned by them and thoroughly prepared for market. It is only necessary to alter the screen or the blast, to enable them to clean large or small and light or heavy seeds. The chief drawback to their general use is their *cost.* Imported machines cost about 120 rupees each; still at this price they would form a good investment for all ryots whose holdings contain at the least 80 acres of arable land, and there are many ryots in this Presidency who hold much larger areas. On such a holding a winnowing machine might, in a single bad season, effect a saving equal to the sum paid for it, by enabling the ryot to prepare his grain for market *whenever favorable* rates are offered, instead of as now, in bad seasons, being obliged to wait with thousands of others for favorable weather, and then with them force produce into market, *only to bring down prices.* Indian corn markets are peculiarly susceptible to the influence of the weather and local circumstances. In dull, close, showery weather ryots cannot prepare their grain for market. The supplies are, therefore, diminished and prices rise, then is the opportunity for the fortunate owner of a winnowing machine, who can clean his grain under cover, send it into market, and secure the high prices then prevailing, his less fortunate neighbours being kept in forced idleness waiting for wind and dry weather. So dependent are ryots on favorable *weather*, for preparing grain for market that it is usual with many when the weather is settled to thresh out and sell *all* their crops immediately after harvest; thus, at that time, *glutting* the market, and bringing down prices *unnecessarily* low. Just after a general harvest, it is not unusual to find grain selling at rates 20 or even 25 per cent. below the prices procurable at other seasons. It is certainly sometimes good policy to sell grain *immediately* after it is harvested, even at a price five or ten per cent. lower than is obtainable at other seasons, but nothing will justify the sacrifice of from 20 to 25 per cent. in the case of a ryot provided with a winnowing machine; for, even if it is not expedient to stack the crop, it can be threshed out *at once*, and the grain can be stored in the chaff under cover, to be winnowed and cleaned as occasion may demand. The saving thus

effected would go a long way towards paying the price of a winnowing machine. A machine of this sort might be held as the *joint* property of a village, or it might belong to the head ryot of a district, who might hire it out to his neighbours. A good machine will, during a single day, clean and fit for market the grain produced by two acres of land. I trust that we will eventually be able to offer a good winnowing machine at one-half the sum the imported machines cost. We have already made up one, which cost *only* 50 rupees, but it does not perform its work as satisfactorily as I could desire.

111. *Chaff-cutter.*—A number of chaff-cutters were obtained from America, and were sold readily. They are made on a much better principle than English chaff-cutters: instead of the cutting knives being fixed on the spokes of the fly wheel as in the English chaff-cutter, they have cylindrical knives set something like those of the lawn mower, the feeding roller being placed immediately behind the knives. The cutting action is thus continuous and less jerkey than in the chaff-cutter with vertical cutters, while by increasing or decreasing the speed of the feeding roller, the chaff can be cut at *different lengths*. They are admirably suited for cutting all sorts of thick straw, for cholum or maize straw they are especially suited. They are a little more expensive than the ordinary English vertical cutters, though if made in *this* country, they might probably be sold at a much less price than we can offer those imported from America. The following is the work done by one of each of these chaff-cutters:—

American cylindrical cutter; cost Rupees 50:—

Worked by two men, nine hours per day. Cuts 70 pounds of cholum straw into chaff per hour.

Cost of Working per Day.

	RS.	A.	P.
Pay of two coolies	0	6	0
Interest and wear and tear, at 15 per cent. per annum charged over 300 working days in the year	0	0	5
Oil, &c.	0	0	3
Total ...	0	6	8

Cost of chaffing one ton of cholum and maize straw Rupees 1-7-8.

English vertical cutters; cost Rupees 36:—

Worked by two men nine hours per day. Cuts 45 pounds of cholum or maize straw into chaff per hour.

Cost of Working per Day.

	RS.	A.	P.
Pay of two coolies	0	6	0
Interest and wear and tear, at 15 per cent. per annum charged over 300 working days in the year	0	0	3
Oil, &c.	0	0	2
Total ...	0	6	5

Cost of cutting one ton of maize or cholum straw into chaff Rupees 2-2-11.

Thus, the American machine can chaff cholum or maize straw at 30 per cent. less cost than the English machine, though its first cost is nearly 40 per cent. greater, proving what I have so frequently pointed out *that a low priced machine does not necessarily perform the cheapest work*, and that *an efficient machine, though its first cost may seem high, is often the cheapest machine in the long run.* This is too frequently lost sight of by those who would provide the ryots only with the rudest description of implements and tools. In the instance

just referred to *the extra charge for interest and wear and tear on the more costly machine is only two pies per day*—a very insignificant sum when it is remembered that *with such a machine the manual labor expended will go 50 per cent. further* than with the cheaper machine.

112. *Cattle weighing scale.*—We have succeeded in making a very efficient weighing scale for live cattle and for general farm purposes. It consists of a large beam suspended on a tripod with a pan for weights and a cage for the animal or thing to be weighed. It will hold 500 pounds of fodder or a bullock weighing 1,000 pounds, and is equally well suited for weighing sheep and articles or produce weighing only a few pounds. It is composed entirely of iron, and needs less adjusting from changes in the weather than when partly constructed of wood. We were already provided with a large weigh-bridge; but it was troublesome to weigh live stock on this machine, and it was seldom in order, frequently varying as much as 10 pounds in a hundred weight, as to enable it to weigh below 100 pounds it was necessary to keep the knife edges, on which the platform is balanced, very sharp, and these seldom stood long when heavy weights were brought to bear on them. It was impossible to keep this machine sufficiently accurate for weighing light weights, and to use it, at the same time, for *heavy* weights. Besides, it was not possible to ascertain when the machine was weighing incorrectly, except by testing it after every weighing, and, as this was not always convenient, errors frequently arose ; but, with the new balance scale, it is only necessary before each weighing to remove the weights, and the accuracy of the scale can be ascertained at a glance.

113. *Four-wheeled waggon.*—A waggon made from an old trolley has been found very useful during the past year. One pair of cattle can with it perform as much work as *two* pairs with our improved carts ; indeed, when carting bricks, tiles, &c., we frequently bring a load equal in quantity to that brought by three country carts. Of course, the waggon cannot be *generally* adopted, neither is this desirable, for there are many circumstances under which the two-wheeled cart would answer in every way better ; but where roads are good and agricultural produce has to be conveyed long distances, the four-wheeled waggon is infinitely superior to the cart. I have removed bricks and tiles a distance of seven miles with a waggon and a pair of cattle at 50 *per cent. less cost* than I would have been obliged to incur had I employed *country* carts, at the same time hiring my own cattle with driver at 12 annas per day, and allowing a sufficient sum to keep up the waggon and pay interest on the sum it cost.

114. *Chain water-lift.*—One of these machines for cattle-power was obtained from Australia. It was fixed in a well in which the level of the water is generally about 25 feet below the surface of the ground ; but the draught was found excessively heavy. Three cattle were required to work the machine, and it was found necessary to keep them travelling at nearly four miles per hour—a most unnatural speed for ordinary working cattle. The gearing was altered, in order to reduce the speed, but it was then found difficult to bring up the water. An intermediate multiplying gear was also employed, but this produced no better results. It is evident that the lift is *too* great to admit of cattle being employed. They cannot give the speed required, and multiplying gearing increases the draught too much, while if there is the least irregularity in the action of the cattle, the water from the great length of the tubes ceases to flow, causing the strain on the gearing to be very irregular. I shall fix this machine where the lift will not be more than 14 or 15 feet. In such a situation I believe it will do its work well. It throws a *very* large quantity of water when it can be kept going.

Overseer.

115. I have again the pleasure to report my satisfaction with the manner in which the Overseer, Mr. J. G. Young, has performed his duties, which, during the past year, owing to the increase of work in the implement shops, and to my absence for three months on duty elsewhere, have been more than usually arduous and responsible. Much credit is due to him for the successful working of the implement shops.

Distribution of Seeds.

116. The following quantities of agricultural seeds were distributed gratuitously during the past year :—

	Pounds.
Cotton seeds	3,152½
Maize	269½
Yellow cholum	157
Carolina paddy	586
Chinese sugar-cane (Sorghum saccharatum)	107½
Total ...	4,272½

117. The farm paid all packing charges, and in most instances the cost of conveying the seed to its destination.

118. The balances referred to in paragraph 236 of last report were carried to the debit of the general granary account, which account is now credited with all seed issued.

119. The Appendix contains a detailed list, recording the different localities in which the seeds were distributed.

THE MADRAS MODEL FARM.

120. *Permanent Improvements.*—In my report for 1870-71 I briefly detailed what was done in that year towards establishing a Model or Commercial Farm on the northern portion of the estate at Sydapet, as well as the cost incurred in performing the various works of a permanent character. Since then we have found it necessary to incur further expense in erecting a slaughter-house, in increasing the size of the fowl-house and yard, and in completing other works of a permanent character, thus :—

	Rs.	A.	P.
Levelling and laying out fields	539	15	3
Buildings	303	5	2
Fences	8	9	0
Total ...	851	13	5

Including the expenditure in 1870-71, the total sum sunk on landlord's or permanent improvements is Rupees 4,374-8-7; on which sum the farm pays 7½ per cent. per annum.

121. *Season.*—As I have elsewhere recorded, the past season was a *very* unfavorable one for the cultivation of dry soils, and this farm, which is essentially a *dry* land farm, suffered severely. The soils from their exhausted state are quite incapable of supporting a crop during a long drought. They have been cropped and cropped for so many years without anything but a few loads of ashes having been returned to them that they are now not only *extremely* poor in the mineral food of plants, but also in organic matter, which by its physical action tends so much to support crops during very dry weather, but this defect will be remedied as the farm grows older.

122. *Manure.*—A considerable quantity of sulphate of lime, the refuse of Soda Water Manufactories, was used on the farm with good effect, especially on soils which, from having previously been under irrigation, or from bad drainage, had become sour and unhealthy. Brickyard refuse was also used to some extent for a similar purpose. Saltpetre was tried; but, except on soils containing a fair proportion of organic matter, the results were not very satisfactory; to some extent the long drought will explain the inefficiency of this mineral on many crops during the past season. A large quantity of valuable manure was made in the cattle boxes; the 30 boxes during the year yielded not less than 500 loads of excellent manure. Wood ashes and cow dung ashes were obtained from the neighbouring villages

and kilns whenever carts could be spared for the purpose. These ashes, especially the cow dung ashes, were used with good effect as top-dressings before hoeing or cultivating Madder, wild indigo, wild croten, &c., were collected for use in the green state as manure for paddy land, for which purpose also as much farmyard manure as could be spared was used, while in one or two instances growing crops were ploughed in as green manure. The result of this last-mentioned way of enriching our poor sands in organic matter is so satisfactory that next season I shall put down leguminous crops, such as horse gram, green gram, and mochakotai, specially for this purpose, on some of the ground intended for cold weather crops. Oil cake (castor oil and ilpa cake) was also used to some extent, but not nearly to the extent that I now feel certain it might have *profitably* been used. We will for sometime experience difficulty in getting manure for the *whole* of the farm; but I feel confident that this difficulty will disappear with each year of our experience. The result of last year's efforts in this direction makes me feel very sanguine on this point. We have in our farmyard manure ashes, oil cake, lime, tank earth, kiln refuse, and green manure as complete a set of *low priced* efficient manures as the condition of our agriculture appears to demand.

123. *Crops.*—The *early* cold weather crops sown in September did very fairly; but crops sown after the *heavy* rains of the monsoon had ceased were in most cases very inferior. One or two good crops of maize were grown on the stiffer of the dry soils, and one or two very fair crop of cholum and green gram. The samples of grain produced on the manured ground were in several instances *very* good; indeed, this farm obtained at the Madras Horticultural Society's show the following prizes for the produce it exhibited :—

	RS.
For Carolina paddy, first prize	20
For green fodder, second prize	10
For maize do. do.	10

The return from the wet crop was also unsatisfactory, as the water-supply did *not* hold out until the paddy crops were matured. There was enough water in the tank in the end of November to have sufficed for six months' cultivation on *all* the land entitled to get a supply; but our neighbours looked more to an *immediate* than to a *future* supply, and *used the water so lavishly* that *it was exhausted in half the time it should have lasted.* If in tanks of this kind something could be done to regulate the size of the discharging vents, according to the area of land entitled to get the water, and a person appointed to see that the water is not wasted (to be paid by the proceeds of a water rate charged on all the lands watered by the tank) all who get the tank water would be benefited, and for the payment of something like half a rupee per acre, we would have a supply of water for nearly twice the length of time we now get it, and this would enable us in addition to a crop of paddy to grow a crop of raggy or some other crop that requires little water. It is mortifying to have paddy land lying idle six or seven months in the year when *a little care in using the water* would enable it to be under crop for nine months at the least.

124. *Live stock.*—A number of cattle were fattened and sold; but beyond the fact that they enabled us to convert our green fodder into excellent manure, the general results were not very encouraging. There not being a market for the sale of fat stock in Madras, we had no alternative but to kill and distribute the meat at the farm; and, as elsewhere stated, this was attended with many difficulties, and in some cases by loss. The results were more satisfactory in former years; but, to some extent, this can be explained by the different time of year at which the few cattle we then fed were slaughtered. Sheep, pigs, and poultry have been added to the live stock of the farm with gratifying results. The pigs have been particularly successful, there being always a large demand for pork.

125. *Financial results.*—For the reasons already given in referring to the season in this and in the report on the Experimental Farm, the financial results attending the working of this farm, during the year under review, were not so good as under other circumstances they would undoubtedly have been. The expenditure during the year was as follows :—

	Rs.	A.	P.
Rent, rent charge, and interest	831	1	8
Labour, including Overseer's pay	1,745	9	11
Cattle	420	10	0
Sheep	135	9	8
Pigs	99	0	0
Poultry, rabbits, &c.	76	3	0
Implements, &c.	18	13	0
Seed	91	6	7
Grass and straw	6	0	0
Cattle food, &c.	551	7	3
Manure	71	1	4
Sundries	100	2	3
Total...	4,147	0	8

And the income was as below :—

	Rs.	A.	P.
Advance from General Funds	1,310	3	11
Cattle	560	14	9
Sheep	141	10	6
Pigs	263	14	0
Poultry, rabbits, &c.	97	8	0
Fruits, plaintains, and vegetables	582	10	3
Hay, grass, and straw	256	6	0
Grains	705	9	3
Sundries	228	4	0
Total...	4,147	0	8

The following is the balance sheet on the 31st of March 1872 :—

Liabilities.

	Rs.	A.	P.
Loan from General Funds 1870-71	2,776	9	10
Do. do. 1871-72	1,310	3	11
Overseer's and Labourers' pay due for March 1872	152	12	7
Total...	4,239	10	4

Assets.

	Rs.	A.	P.
Cattle—			
18 Working bullocks...	1,554	0	0
8 Feeding cattle			
Sheep—			
17 Ewes	145	0	0
2 Wethers			
5 Gimmers			
14 Lambs			
Pigs—			
6 Sows	320	0	0
5 Geldings			
8 Young			

Poultry—		Rs.	A.	P.
2 Cocks, Brahma-Dorking				
6 Hens do.				
29 Chickens do.		115	0	0
9 Country hens				
16 Geese				
25 Ducks				
Rabbits—				
9 Full grown		7	0	0
2 Young				
Implements—				
Carts, tools as catalogued		490	0	0
Manures—				
Farmyard and other manures		180	0	0
Half cost of manure applied during the year		35	0	0
Half cost of cake consumed during the year		200	0	0
Straw		30	0	0
Young fruit trees—				
1,000 Plaintain trees...				
100 Cocoanut do.		400	0	0
63 Mango do.				
Growing crops—				
Fruit on trees	155 0 0			
Fodder crops	175 0 0			
Hay field	25 0 0			
Paddy...	20 0 0			
		375	0	0
Uncollected bills...		146	11	6
Cultivations done for the next seasons's crop...		85	0	0
Total...		4,082	11	6

There is thus a sum amounting to Rupees 156-14-10 against the farm. This is to be regretted, but is no cause whatever for any feeling of doubt as to the eventual success of the experiment, and this is the more apparent when we begin to analyze the expenditure, thus :—

(*a*). The farm, which contains 120 acres of land, embracing within its area some of the poorest land under cultivation, paid last year in rent, rent charge, and in interest on the working capital Rupees 831-1-8, or *nearly 7 rupees per acre.*

(*b*). It paid an Overseer—who, in this instance, fills the place of the ryot—during the year Rupees 450, besides giving him a free dwelling, firewood, &c., worth an additional 100 rupees per annum, or a total of Rupees 550—*an income that few ryots enjoy.*

(*c*). It paid in wages Rupees 1,295-9-11, and employed on the average, 18 men, 1 woman, and 3 boys throughout the year, paying them at the following rates :—A ploughman Rupees 6 per month, an ordinary cooly Rupees 5 per month, a woman Rupees 3 per month, and a boy Rupees 2½ to Rupees 3 per month. *The large number of persons employed throughout the year on regular wages is no unimportant advantage that an improved agricultural practice confers on a neighbourhood.*

(*d*). It paid Rupees 551-7-3 for cattle food, and fully two-thirds of the food thus purchased was consumed by the working cattle. This expense we might have avoided had we adopted the practice usually followed by ryots, and have turned our working cattle into the fields and roads after their day's work was finished to eke out a scanty allowance of straw with the aid of such food as they could find on the sides of fences, roads, and water-courses. Had he followed this practice, *we might have avoided the expenditure of upwards of 350 rupees, and thus have had a small balance to our credit.*

The receipts were seriously diminished by the effects of the long drought on our soils, which are yet *in a poor exhausted condition.* A similar drought, two or three years hence, would not produce such ill-effects, as by that time, I trust, by the aid of manure and deeper cultivation, we will have enabled our dry soils to carry crops over a drought fully as long as that we experienced last season.

126. I have brought to account in the valuation sheet under head "Manure" the unexhausted value of the manure purchased and used during the year and the manural value of the oil-cake consumed. These items, though novel to farm balance sheets in this country, always form part of a farm balance sheet at home; indeed, in some counties as much as two-thirds of the cost of the manure purchased and of the oil-cake consumed in the year is placed to the debit of the next year's account, or is paid by the in-coming tenant, should the old tenancy terminate—an arrangement based on the *ordinary* rules of trade; for the balance sheet of no manufactory would show the *actual* financial state of the enterprise, if *it omitted to bring to account the raw material purchased and paid for lying in the stores ready for manufacture.* The farmer like the manufacturer, if he wants to succeed in his work, must *always* have on hand a large quantity of raw material in his soil which possesses a certain market value.

127. On the whole the results of the first complete year's work on this farm is satisfactory, for much yet remains to be done to put the experiment on a *regular* footing. A *soil, like a horse, is kept in condition much easier and at less cost after it has once been brought into good condition, than before it reaches this state.* Land out of condition is more costly to work and keep in order than land under thorough cultivation, while the crops on land in a bad condition are always more subject to injury by drought, blight, insects, &c., than are the crops on *well* cultivated land. We must for a few years expect to suffer more or less from the causes just mentioned; but these influences will be less and less hurtful as the experiment advances in age.

Overseer.

128. I have again the pleasure to record my satisfaction with the general conduct of the Overseer, Mr. F. Wilkins, and with the manner in which he has performed his duties.

Implement Workshops.

129. These workshops supplied during the year 15 iron ploughs, 24 combined ploughs, 131 ploughshares, 306 improved reaping knives, 6 iron cultivators, 3 chaff cutters, 3 maize shellers, 3 iron harrows, 1 winnowing machine, 1 corn crusher, 1 steaming apparatus, 9 plough yokes and swingletrees, 8 wheel hoes and smaller tools, besides executing a large amount of repairs. The following are the details of income and expenditure during the past year :—

Expenditure.

	Rs.	A.	P.
Buildings	62	2	6
Plant	119	15	0
Machines, &c.	1,298	7	9
Labour, materials, &c.	1,869	6	5
Interest on capital	50	0	0
Total ...	3,399	15	8

Income.

	Rs.	A.	P.
Advance from General Funds	213	1	2
Machines, &c.	2,364	10	9
Labour, &c.	822	3	9
Total...	3,399	15	8

IMPLEMENT WORKS BALANCE SHEET FOR THE YEAR ENDING 31ST OF MARCH 1872.

Liabilities.

	Rs.	A.	P.
Loan from General Funds 1870-71	883	1	5
Do. do. 1871-72	213	1	2
Labourers' pay due for March 1872	120	12	3
Total ..	1,216	14	10

Assets.

	Rs.	A.	P.
Buildings	419	15	3
Plant	260	3	0
Materials	47	2	0
New implements, machines, &c., in stock	226	8	0
Outstanding bills...	255	4	0
Deficiency	7	14	7
Total...	1,216	14	10

There is thus a small deficiency amounting to Rupees 7-14-7 against the workshops, and this is after paying all expenses and interest on the capital employed. But the loss is only a book loss. The result of the experiment is *very far from being a loss*, for we have reaped *many* advantages by the establishment of these workshops here that cannot well be brought to account in a balance sheet, though we might justly place to the credit of the workshops the large annual saving effected in the cost of repairing, altering, and making up machines for experimental purposes. The farm *is charged only the actual value of the materials, and time employed with an addition of five per cent. to meet contingencies, &c.*, while *its work is performed on the spot, without delay*, by men who know something of the nature of the operation, the machine, implement, or tool is expected to perform. Before these workshops were started, we had to send our implements, &c., eight miles for repairs ; had to wait frequently at *very* great inconvenience two or three weeks, sometimes much longer before the repairs were executed ; had to send again eight miles to bring them back to the farm ; and *invariably* had to pay *very* high charges for the work done ; while it was seldom possible to get new machines, &c., made to perform the particular work required of them. English and American machines generally need to be altered before they are suited for this country. The amount of alteration required can easily be ascertained and executed at the farm, while any improvement suggested by our practice in the field can be carried into effect *at once*. There are many other ways in which we benefit from our workshops ; indeed, it is not too much to state that, without their aid, it would have been impossible to have carried out many of the improvements effected during the past year in the working parts of our machines, &c., while our expenditure on this part of our work would have been at the least 50 *per cent. greater*. In conclusion, I would add that for making new machines, or for executing repairs or alterations in machines, &c., we charge in these workshops only the *actual* cost of the materials used, the value of the labour employed and an additional 5 per cent. to meet contingencies. *We seek no profit.* Our only object is to pay expenses and afford greater facilities for the more general use of improved machines and implements.

(Signed) W. R. ROBERTSON, M.R.C.A.,
Superintendent, Government Farms.

APPENDICES.

Rainfall registered at the Experimental Farm during the year ending March 31st, 1872.

April 1871.	May 1871.	June 1871.	July 1871.	August 1871.	September 1871.	October 1871.	November 1871.	December 1871.	January 1872.	February 1872.	March 1872.
1	1 ...	1 ...	1 ...	1 ...	1 ...	1 ...	1 ... 4·38	1 ...	1 ...	1 ...	1 ...
2	2 ...	2 ...	2 ... ·89	2 ...	2 ...	2 ...	2 ... ·85	2 ...	2 ...	2 ...	2 ...
3	3 ...	3 ...	3 ...	3 ...	3 ...	3 ...	3 ... ·30	3 ...	3 ...	3 ...	3 ...
4	4 ...	4 ... ·79	4 ...	4 ...	4 ...	4 ...	4 ... ·60	4 ...	4 ...	4 ...	4 ... ·06
5	5 ...	5 ...	5 ...	5 ...	5 ...	5 ... ·59	5 ...	5 ...	5 ...	5 ...	5 ...
6	6 ...	6 ...	6 ...	6 ... ·35	6 ...	6 ...	6 ...	6 ...	6 ...	6 ... ·75	6 ...
7	7 ...	7 ...	7 ...	7 ...	7 ...	7 ...	7 ... 3·85	7 ...	7 ...	7 ...	7 ...
8	8 ...	8 ...	8 ...	8 ...	8 ... ·33	8 ...	8 ... 3·65	8 ...	8 ...	8 ...	8 ...
9	9 ...	9 ...	9 ...	9 ...	9 ...	9 ...	9 ... 5·14	9 ...	9 ...	9 ...	9 ...
10	10 ...	10 ...	10 ...	10 ...	10 ...	10 ...	10 ... ·59	10 ...	10 ...	10 ...	10 ...
11	11 ...	11 ...	11 ...	11 ...	11 ...	11 ...	11 ...	11 ...	11 ...	11 ...	11 ...
12	12 ...	12 ... ·10	12 ...	12 ...	12 ...	12 ...	12 ...	12 ...	12 ...	12 ...	12 ...
13	13 ...	13 ...	13 ... 2·75	13 ...	13 ...	13 ...	13 ... ·40	13 ...	13 ...	13 ...	13 ...
14	14 ...	14 ...	14 ...	14 ...	14 ...	14 ...	14 ... ·16	14 ... ·19	14 ...	14 ...	14 ...
15	15 ... ·33	15 ...	15 ... 1·45	15 ... ·95	15 ...	15 ...	15 ... 1·08	15 ...	15 ...	15 ...	15 ...
16	16 ...	16 ...	16 ... ·45	16 ...	16 ...	16 ...	16 ...	16 ...	16 ...	16 ...	16 ...
17	17 ...	17 ...	17 ...	17 ...	17 ... 3·75	17 ... ·29	17 ...	17 ...	17 ...	17 ...	17 ...
18	18 ...	18 ...	18 ...	18 ...	18 ... 1·05	18 ... 3·38	18 ...	18 ...	18 ...	18 ...	18 ...
19	19 ...	19 ...	19 ...	19 ...	19 ...	19 ... ·22	19 ...	19 ...	19 ...	19 ...	19 ...
20	20 ...	20 ...	20 ... ·45	20 ...	20 ...	20 ... ·50	20 ...	20 ...	20 ...	20 ...	20 ...
21	21 ...	21 ... ·45	21 ...	21 ...	21 ...	21 ... ·09	21 ...	21 ...	21 ...	21 ...	21 ...
22	22 ...	22 ...	22 ...	22 ...	22 ...	22 ..	22 ... ·19	22 ...	22 ...	22 ...	22 ...
23	23 ...	23 ...	23 ...	23 ...	23 ...	23 ...	23 ... 4·43	23 ...	23 ...	23 ...	23 ...
24	24 ...	24 ...	24 ... ·65	24 ...	24 ...	24 ... 1·14	24 ...	24 ...	24 ...	24 ...	24 ...
25	25 ...	25 ...	25 ...	25 ...	25 ...	25 ...	25 ...	25 ...	25 ...	25 ...	25 ...
26	26 ...	26 ... ·10	26 ...	26 ...	26 ...	26 ...	26 ... 1·02	26 ...	26 ...	26 ...	26 ...
27	27 ...	27 ...	27 ...	27 ...	27 ... 1·20	27 ...	27 ...	27 ...	27 ...	27 ...	27 ...
28	28 ...	28 ...	28 ... ·25	28 ...	28 ...	28 ...	28 ...	28 ...	28 ...	28 ...	28 ...
29	29 ...	29 ...	29 ...	29 ... ·49	29 ... 1·90	29 ...	29 ...	29 ...	29 ...	29 ...	29 ...
30	30 ...	30 ...	30 ...	30 ...	30 ...	30 ...	30 ...	30 ...	30 ...		30 ...
	31 ...		31 ...	31 ...		31 ...		31 ...	31 ...		31 ...
Total ...	·33	1·14	6·89	1·79	8·23	6·21	26·64	·19		·75	·06

VALUATION OF LIVE AND DEAD STOCK AT THE EXPERIMENTAL FARM ON THE 31ST MARCH 1872.

Live Stock.

		RS.
Cattle—		
3 Bulls		1,780
25 Working Cattle		
6 Feeding Cattle		
Sheep—		
29 Rams		810
60 Ewes		
31 Gimmers		
43 Lambs		
Pigs—		
3 Boars		300
5 Sows		
5 Young		
Rabbits		10
Poultry		60
	Total ...	2,960

Manure.

Guano, Bones, Charcoal		200
Foldyard and other manures		
	Total ...	3,160

Growing Crops.

	RS.
Fodder (of sorts)	100
Sugar-cane	100
Guinea grass	80
Paddy	50
Cotton	200
Cocoanut trees	75
Grass	50
Total ...	655

Farm Seeds.

		RS.
2,608 lbs.	of Varagoo	15
367 „	Red cholum	8
98 „	Green gram	4
105 „	Ground nuts	1
408 „	Castor oil seed	18
465 „	Raggy	6
990 „	Red car paddy	6
61 „	Corcapilly seed	4
836 „	Shamay	20
6,235 „	Cotton	60
3,131 „	Tennay	25
7,290 „	Chumba paddy	80
1,930 „	Carolina paddy	25
825 „	Car paddy	10

		Rs.
200	lbs. Yellow cholum	4
3,800	„ Cumboo	70
1,895	„ Sorghum saccharatum	60
9,302	Cobs Mackey maize	93
3,968	„ Queensland maize	39
Other seeds		10
	Total ...	558

Cattle Food.

10,725 lbs. of ground nut cake	125

IMPLEMENTS.

Implements and tools as catalogued in inventory	6,920
Grand Total ...	11,418

Seed distributed.

Date.	To whom despatched.	Maize.	Cotton.	Yellow Cholum.	Carolina Paddy.	Sorghum saccharatum.
1871.		lbs.	lbs.	lbs.	lbs.	lbs.
17th April.	Mr. Monaghan	10	...	...	...	2
11th May.	Honorary Secretary to Horticultural Society, Madras	...	...	...	6	...
Do.	Cotton Commissioner, East Berar	60	...	...	60	10
27th May.	Honorary Secretary to Horticultural Society, Madras	10	...	5	...	5
30th do.	Do. do.	20	...	...	...	...
5th June.	Do. do.	...	...	...	20	...
6th do.	Honorary Secretary Horticultural Society, Bangalore	...	...	100	...	...
Do.	Honorary Secretary to Alfred Model Farm, Ceylon	10	...	10	...	10
7th June.	Veerasawmy, Ryot...	2	...	...	...	2
14th do.	The Collector of Coimbatore	...	560	...	...	...
Do.	Do. Cuddapah	...	275	...	...	...
Do.	Do. Trichinopoly	...	125	...	...	...
15th June.	Do. Bellary	...	275	...	...	...
16th do.	Do. Kurnool	...	560	...	...	...
24th do.	J. J. Higginbotham, Esq., Madras	5	...	...	...	...
27th do.	The Collector of Kistna	...	560	...	...	...
Do.	The Superintendent of Inam Commission Office...	5	...	...	20	5
28th June.	Sharp, Esq....	...	50	...	...	...
1st July.	Ryots (various)	12	20	...	...	5
4th do.	Mr. Adolphus, Madras	5	20	...	10	5
25th do.	Honorary Secretary Horticultural Society, Madras.	...	1	...	...	...
1st Aug.	The Commissary-General, Madras	2½	...	5	...	5
5th do.	The Superintendent of Central Jail, Coimbatore...	...	125	...	...	...
Do.	Do. Lunatic Asylum, Madras..	1	45	...	...	...
16th Aug.	The Collector of North Arcot	...	100	...	...	...
25th do.	Do. Madura	...	130	...	...	...
26th do.	The Superintendent of the School of Arts, Madras.	...	...	3	...	3
11th Sept.	J. Deschamp, Esq., Madras	...	...	3	...	3
18th do.	J. Jones, Esq., Madras	6	...	...	...	...
19th do.	The Assistant Superintendent, Andamans, Nicobar.	...	25	...	...	19
20th do.	The Superintendent Inam Commission	...	50	20	10	5
Do.	The Commissioner of Police, Madras	...	10	...	...	...
29th Sept.	Captain Campbell	...	1	...	...	...
Do.	The Superintendent of Central Jail, Coimbatore...	...	1	...	...	...
Do.	Messrs. Binny and Co., Madras	6	...	...	...	...
3rd Oct.	Appavoo Pillay, Madura	3	1½	1	...	1½
5th do.	S. Viziaragavaloo Chetty, Esq.	...	40	...	...	10
7th do.	The Inspector of Police, Sydapet	1	3	5	...	2
13th do.	Dr. Pritchard, Madras	3	...	...	...	...
16th do.	The Government Agent, North-East Provinces, Batticolar, Ceylon	...	85	...	...	...
Do.	The Sanitary Commissioner, Madras	5	...	...	5	...
25th Oct.	The Collector of Malabar	...	...	...	100	...
Do.	Do. Kistna	...	...	...	100	...
31st Oct.	J. Jones, Esq., Madras	...	...	5	...	5
10th Nov.	Ryots	...	5	...	...	5
20th do	The Collector of Ganjam	...	...	...	130	...
20th do.	Do. Madura	...	...	...	100	...
Do.	Do. Nellore	...	45	...	..	5
24th Nov.	Honorary Secretary Alfred Model Farm, Ceylon...	...	20	...	...	...
8th Dec.	The Superintendent of Inam Commission ...	3	...	...	5	...
1872.						
10th Jan.	His Highness the Rajah of Vencatagherry ...	40	...	...	20	...
14th Feb.	Mrs. Morgan, Ooty	30	10	...	...	...
Do.	W. G. McIvor, Esq., Ootacamund	30	10	...	...	...
	Total ...	269½	3,152½	157	586	107½

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st of April 1872.

1 Portable steam engine, 8-horse power, by Ransomes and Sims.
1 Set of steam ploughing and cultivating apparatus, tackle, windlass, porters, &c., by Fowler & Co.
1 Chaff-cutter and universal mill with bullock-power, by Ransomes and Sims.
1 Threshing machine with a bullock-power, by Emery Brothers.
1 Threshing machine, by Dray Taylor and Co.
1 Threshing machine with bullock gear and carriage, by Ransomes and Sims.
1 Threshing machine with bullock gear and carriage, by Garret and Co.
1 Winnowing machine, by Dray Taylor & Co.
2 Winnowing machines, by Garret and Co.
1 Winnowing machine, by Ransomes and Sims.
1 Winnowing machine, by R. T. Smith.
1 Winnowing machine, by Hornsby and Sons.
3 Reaping machines, by Samuelson and Co.
1 Drill sowing macine, 8 rows, by Garret and Co.
1 Cylindrical corn screen, by Ransomes and Co.
2 Ploughs, by Ames and Co., Boston.
1 Turn-wrest plough and yoke, by Ransomes and Co.
1 Stone roller.
2 Drill sowing machines, 13 rows, by Garret and Co.
1 Wood-drag harrow, by Experimental Farm.
2 Sets of iron prong harrows with swingletrees, by Ransomes and Sims.
2 Iron chain harrows.
1 Iron grubber.
1 Combined grubber.
4 Bullock hoes.
2 Bullock ploughs, by Howards and Co.
1 Bullock plough, by School of Arts.
2 Bullock ploughs, by Mint.
2 Bullock ploughs, by Ransomes and Sims.
1 Double mould-board plough.
1 Large plough with 2 wheels, by Ransomes and Sims.
1 Swing-plough, by Roorkee Workshop.
1 Mould-board country plough, by Experimental Farm.
1 Wood swing-plough by Ransomes and Sims.
1 Wet-land plough, by Experimental Farm.
1 Country drill, by Experimental Farm.
1 Wooden roller.
1 4-wheel waggon.
1 Stone trolley.
1 Root-pulper, by Ransomes and Sims.
3 Country carts.
1 Water cart.
1 Sewage cart, by Gun Carriage Works.
1 Maize-sheller, by Ainsworth and Co.
1 Corn drill.
1 Barrow drill, by Experimental Farm.
1 Rain gauge.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
1 English ladder.
1 Norton's tube-well with a rotary motion.
1 English grind stone.
1 Farm bell.
2 Wheel hand hoes.
11 Cattle yokes.
2 Single bullock carts.
1 Overhead, bullock-power, with shafts and gearing.
1 Sugar-cane mill.
1 Californian pump.
1 Archimedian pump.
1 Maize-sheller, by Ransomes and Sims.
1 Cake-crusher.
1 Steaming apparatus, Richmond and Chandlar.
1 2-wheel plough with cultivator, by Ransomes and Sims.
1 Pump, by Roorkee Workshop.
1 Chaff-cutter, manual-power.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon and Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
6 English carts.
1 Malabar spoon bale.
1 Waterproof cart-cover.
1 Sack-barrow.
1 Portable scale with weights.
5 Piccottah buckets.
2 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
15 Wheel-barrows.
3 Hay frames for carts.
1 Farm clock.
3 Tables.
10 Chairs.
1 Writing desk.
2 Almyrahs.
1 Iron cash-chest.
1 Dynamometer.
1 Surveying level with stand-staves, &c.
1 Set of bottle levels.
Chemical apparatus, mortars and pestles, glass-breakers, &c.
28 Feeding tubs.
5 Metal-feeding troughs.
3 Scythes.
1 Manure drag.
2 Bengal picks.
2 Dutch hoes.
2 Bengal hoes.
8 Hand hoes.
6 Forks of sorts.
7 Iron rakes.
18 Mamooties.
A number of spanners.
2 Hammers.
3 Hatchets.
3 Jumpers.
4 Quarrying crowbars.
17 Crowbars.
23 Picks.
3 Mattocks.
2 Hedge shears.
2 Bill hooks.
1 Iron reel.
8 Grass knives.
3 Manure forks.
15 Digging forks.
6 Shovels.
4 Sets of bullock harness.
1 Cart saddle.

1 Water bridle.
2 Surveying chains with pins.
3 Iron cistern.
A quantity of wire, rope, and a large number of details belonging to steam plough.
35 Specimen seed bottles.
2 Hedge knives.
5 Pairs of thorn pincers.
1 Ear punch for marking sheep.
1 Branding iron for marking sheep.
1 Marcal, 1 half-marcal, and 1 measure.
6 Scythe stones.
2 Weeding spuds.
3 Pairs of sheep shears.
2 Planter's hoes.
1 Fork hoe.
1 Pruning knife.
1 Dibble.
1 Pick hoe.
1 Bill hook.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1st of April 1872.

2 Iron ploughs.
2 Combined ploughs.
1 Set iron harrows with swingletree.
2 Country carts.
1 Box cart.
6 Reaping hooks.
6 Hand hoes.
8 Piccottah buckets.
1 Chopper.
21 Feeding tubs.
1 Levelling board.
2 Spades.
3 Small wheel-barrows.
1 Clock.
6 Digging forks.
7 Yokes.
1 Table.
2 Hand saws.
1 Knife.
1 Hay fork.
1 Mamooty.
1 Pair pincers.
1 Hammer.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Bell.
1 Water cask.

List of Tools, &c., in the Implement Works on the 1st of April 1872.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
18 Tongs.
2 Bellows.
2 Screw plates.
4 Sledge hammers.
6 Small hammers.
6 Chisels, " Smiths.' "
6 Punches.
1 Counter-sinking punch.
4 Dies or flat chisels.
1 Pair calipers.
1 Iron square.
3 Round files.
1 Half-round file.
7 Flat files.
16 Laps for screw plates.
1 Iron brace and 5 bits.
1 Filer's hammer.
1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
1 Bench with 2 vices.
3 Hand saws.
1 Pit saw.
1 Cross-cut saw.
7 Augurs.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincers.
1 Compass.
6 Carpenter's chisels.
1 Cold chisel.
2 Set squares.
1 Angle square.
6 Gimlets.
1 Brace with 36 bits.
2 Adzes.
1 Hammer.
1 Turn-screw.
1 Plummet.
3 Saw files.
4 Rasps for wood.

Catalogue of Books in the Farm Library on the 1st of April 1872.

Library No.	Title, Part or Number, Date, Author, &c.
1.	Journal of the Royal Agricultural Society of England, Part 1, Vol. 21, 1860.
2.	Do. do. do. 1, do. 2, 1866.
3.	Do. do. do. 2, do. 20, 1859.
4.	Do. do. do. 2, do. 22, 1861.
5.	Do. do. do. 2, do. 22, 1861.
6.	Do. do. do. 1, do. 25, 1864.
7.	Do. do. do. 2, do. 25, 1864.
8.	Do. do. do. 3, do. 23, 1862.
9.	Do. do. do. 1, do. 24, 1863.
10.	Do. do. do. 2, do. 24, 1863.
11.	Do. do. do. 1, do. 1, 1865.
12.	Do. do. do. 2, do. 1, 1865.
13.	Do. do. do. 2, do. 1, 1865.
14.	Do. do. do. 2, do. 2, 1866.
15.	Do. do. do. 1, do. 3, 1867.
16.	Do. do. do. 2, do. 3, 1867.
17.	Do. do. do. 2, do. 3, 1867.
18.	Do. do. do. 1, do. 5, 1869.
19.	Do. do. do. 2, do. 5, 1869.
20.	Book of the Farm, Vol. 1, 1855, by Henry Stephens, F.R.S.E.
21.	Do. do. 2, 1855, do.
22.	Cotton Cultivation, Madras Presidency, 1862, by J. Talboys Wheeler.
23.	Selections from the Records of the Madras Government, "Report on the Agricultural Exhibitions in the Provinces in the year 1856," No. 45, Vol. 2, 1858.
24.	Report on the Agricultural Exhibitions in the Provinces in the year 1859.
25.	Select Papers of the Agri-Horticultural Society, Punjab, 1868.
26.	Selections from the Records of the Government of India, No. 23, 1857. Tea Culture.
27.	Reports on the Ravages of the Borer in Coffee Estates, 1869, by George Bidie, M.B.
28.	Madras Exhibitions of Raw Products, Arts, and Manufactures of Southern India, 1858.
29.	Observations of the late Dr. William Roxburgh on Substitutes for Hemp and Flax, 1815.
30.	Sorgho Sucre or Chinese Sugar-cane, 1859, by a Massachussetts Farmer.
31.	Madras Exhibitions of Raw Products, Arts, and Manufactures of Southern India, 1856.
32.	Morton's Cyclopædia of Agriculture, Vol. 1, 1863.
33.	Morton's Do. do. 2, 1863.
34.	Useful Plants of India, 1858, by Colonel Drury.
35.	Indian Corn, 1866, by Edward Enfield.
36.	Mechi's Farm Balance Sheets, 1869.
37.	Domestic Fowl, by H. D. Richardson.
38.	Notes on Building and Road-making, 1862.
39.	Illustrated Catalogue of Ploughs.
40.	Cattle and Cattle-breeders, 1869, by William McCombie, M.P.
41.	Rudimentary Chemistry for the use of beginners, 1853, by George Fownes, F.R.S.
42.	Dairy Management and Feeding of Milch Cows, 1868.
43.	Catechism of Practical Agriculture, 1866, by Henry Stephens, F.R.S.E.
44.	Companion to the Blue Mountains, 1850, by J. D. V. Packman, F.L.S.
45.	Notes on the Propagation and Cultivation of the Medicinal Cinchonas or Peruvian Bark Trees, 1867, by William Graham McIvor.
46.	Catechism of Agricultural Chemistry and Geology, 1868, by James F. W. Johnston, M.A., F.R.S.S. & E.
47.	Report on the U. S. Department of Agriculture, 1847.
48.	Do. do. 1848.
49.	Do. do. 1849.
50.	Do. do. 1850.
51.	Do. do. 1851.

Library No.	Title, Part or Number, Date, Authtor, &c.		
52.	Report on the U. S. Department of Agriculture,		1852.
53.	Do.	do.	1853.
54.	Do.	do.	1854.
55.	Do.	do.	1855.
56.	Do.	do.	1856.
57.	Do.	do.	1857.
58.	Do.	do.	1858.
59.	Do.	do.	1859.
60.	Do.	do.	1860.
61.	Do.	do.	1861.
62.	Do.	do.	1862.
63.	Do.	do.	1863.
64.	Do.	do.	1864.
65.	Do.	do.	1865.
66.	Do.	do.	1866.
67.	Do.	do.	1867.
68.	Do.	do.	1868.
69.	Report of the Brazilian Department of Agriculture,		1869.
70.	Do.	do.	1869.
71.	Do.	do.	1869.
72.	Do.	do.	1870.

73. Catechism of Practical Agriculture, 1867, by Henry Stephens, F.R.S.E.
74. Catechism of Agricultural Chemistry and Geology, by Professor J. W Johnstone.
75. The Planter's Manual, 1863, by William Graham McIvor.
76. Glossary of Indian Terms.
77. Report on Cotton Cultivation for the year 1868-69, 1869, by H. Rivett-Carnac, Esq., B.C.S.
78. Encyclopædia of Agriculture, 1825, by J. C. Loudon, F.L.S.H.S., &c.
79. Journal of the Royal Agricultural Society of England, No. 45, Part 1, Vol. 21, 1860.
80. Do. do. No. 7, do. 1, do. 4, 1868.
81. Scientific Dialogue, 1862, by the Rev. J. Joyce.
82. Catechism of Agricultural Chemistry, by W. B. Tegetmeier.
82½. Manual of Geology, 1857, by J. Beete Jukes, M.A , F.R.S., &c.
83. The Hill Ranges of Southern India, Part 1, 1870, by John Shortt, M.D.
84. Professional Papers on Indian Engineering, No. 11, Vol. 1, 1864, by Major J. G. Medley, R.E.; A.I.C.E.
85. Life, its Origin and Succession, 1860, by Phillips.
86. Philosophy of Food and Nutrition, 1799, by Rev. Edwin Sidney, M.A.
87. Rudimentary Mechanics, 1859, Vol. 6, by Charles Tomlinson.
88. First Book of Indian Botany, 1869, by Professor Oliver.
89. The Elements of Natural Philosophy, 1853, by Jabez Hogg, Surgeon.
90. Elements of Botany, 1837.
91. The Principles of Practical Gardening, by George W. Johnson, Esq.
92. Manual of Gardening, 1856, by R. Riddell.
93. Complete Grazier, 1839.
94. Principles of Comparative Physiology, 1854, by Dr. Carpenter.
95. Geography, 1857, by W. R. Chambers.
96. The Farmer's Calendar, 1862, by Arthur Young.
97. New Farmer's Almanac, 1869, by Morton.
98. The Journal of the Royal Agricultural Society of England, 1870, Part 1, Vol. 6.
99. The Journal of the Royal Agricultural Society of England, No. 12, Part 2, Vol. 6, 1870.
100. Profitable Pigs.
101. New Farmer's Almanac, 1870, by Morton.
102. The Physiology of Common Life, Vol. 1, by G. H. Lewes.
103. A Hand Book to Coffee Planting in Southern India, 1864, by John Shortt, M.D.
104. Patent Office Report, Mechanical, 1851.
105. Do. do. 1852-53.

Library No.	Title, Part or Number, Date Author, &c.
106.	Patent Office Report, Part 1, 1853.
107.	Do. do. 2, 1854.
108.	Do. do. 1, 1854.
109.	Do. do. 1854.
110.	Do. do. 1855.
111.	Do. do. 1855.
112.	Madras Land Revenue Reports for fusly 1274 (1864-65).
113.	Do. do. for fusly 1275 (1865-66).
114.	Do. do. for fusly 1276 (1866-67).
115.	Do. do. for fusly 1277 (1867-68).
116.	The Madura Country.—A Manual compiled by order of the Madras Government, 1868, by J. H. Nelson, M.A.
117.	Farm Machines, by Ransomes and Sims, Ipswich, London.
118.	Madras People's Almanac, 1869, by Gantz.
119.	Catechism of Botany, No. 1.
120.	Do. No. 2.
121.	Sheep and Shepherding, by M. M. Milburn.
122.	Sketch of the Families of Plants, 1855, by Arthur Henfrey, F.R.S.
123.	Madras Almanac, 1871, by C. Foster.
124.	The Indian Economist, Vol. 1, 1870.
125.	Chemistry in its application to Agriculture and Physiology, 1842, by Lyon Playfair, Ph. D.
126.	The Vizagapatam District, 1869, by D. F. Carmichael.
127.	Madras Land Revenue Reports for fusly 1278 (1868-69).
128.	Reports on the Cultivation and Preparation of Tobacco in India, 1871, by Dr. Forbes Watson.
129.	Our Mountain Ranges, 1867.
130.	Report on the State and Prospects of the Cotton Crop in the North-West Provinces, 1869-70.
131.	Madras Almanac, 1872, by C. Foster.
132.	The Indian Hand Book of Gardening.
133.	Somerville on the Physical Sciences, 1836, by Mary Somerville.
134.	Timber Trees, 1870, by Edward Balfour, L.R.C.S.E.
135.	Our Farm of Four Acres.
136.	Journal of the Royal Agricultural Society of England, Vol. 7, Part 2, 1871.
137.	Manual of more deadly forms of Cattle Disease in India, 1871.
138.	Modern Farrier, 1846, by G. Lowson.
139.	Indian Cattle Plague, 1871.
140.	The Microscope and its Revelations, 1842, by William B. Carpenter, M.D., F.R.S., &c.
141.	Some Account of Silk in India, 1872, by J. Geoghegan.
142.	The Physiology of Common Life, Vol. 2, by G. H. Lewes.
143.	Tobacco, its Cultivation and Preparation in the Phillippine Islands, 1872, by Don Rafaee. Zaragoza.
144.	Cotton Cultivation in the Punjab in 1870-71.

(Signed) WILLIAM R. ROBERTSON, M.R.C.A.,
Superintendent, Government Farms.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS,

(MADRAS PRESIDENCY)

FOR THE YEAR ENDING 31ST OF MARCH 1873.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT GAZETTE PRESS.

1874.

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MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT GAZETTE PRESS.

1874.

134077

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APPENDIX.

1. Rainfall of the year.
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THE ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT FARMS, FOR THE YEAR ENDING 31ST OF MARCH 1873.

1. *Season.*—The total rainfall of the year was 86·17 inches, or nearly double the average annual rainfall of the previous ten years, and not only was the fall exceedingly large, but the rain was precipitated in unusually heavy showers; thus, though so much rain fell, there were only 62 wet days during the whole year, so that on the average there was 1·38 inches of rain registered for each day on which there was rain. On examining the detailed registrations which appear in the appendix, it will be noticed that there were several days on which more than four inches of rain fell.

2. The following table shows the amount of rain that was registered for each month, and the number of days in each month, on which rain fell during the year, compared with the average monthly registrations, of a similar kind, for the preceding ten years :—

	1872-73.		Average of the previous 10 years.	
	Inches.	Wet Days.	Inches.	Wet Days.
April	...	...	·55	1·1
May	7·55	3	·16	1·2
June	1·41	2	2·96	8·7
July	2·95	6	4·72	11·6
August	6·46	9	5·12	13·1
September	4·96	7	3·71	10·0
October	18·26	10	9·15	11·1
November	31·13	16	11·10	13·9
December	7·22	5	5·62	7·2
January	...	...	1·28	1·3
February	6·23	4	·29	·8
March	...	...	·14	·6
Total ...	86·17	62	44·80	80·6

3. It is undoubtedly convenient to make up each month's rainfall separately, and perhaps in most European countries this is the best arrangement that can be adopted; but in no country, with a climate anything like that we have in Southern India, are monthly averages of rainfall of the least use to agriculture: the period is much too long; we may, in the space of a single month, suffer both from flood and from drought, though the rainfall of the month may even be above the usual average. In this country a week is, I think, a sufficiently long period for which to make up the rainfall returns. The table I have already given shows our rainfall registrations in the way such results are usually exhibited. The following table shows them as, I think, they ought to be exhibited :—

—	1872-73.		Average of the previous 10 years.		—	1872-73.		Average of the previous 10 years.	
	Inches	Wet Days	Inches	Wet Days		Inches	Wet Days	Inches	Wet Days
1t Week ...	...	...	...	...	28th Week ...	9·94	4	·31	1·1
2nd do. ...	...	...	·01	·1	29th do. ...	6·48	3	4·66	3·9
3rd do. ...	...	...	·20	·3	30th do. ...	1·20	2	1·90	3·2
4th do. ...	...	...	·35	·7	31st do. ...	...	...	2·36	2·9
5th do. ...	7·55	3	·01	·1	32nd do. ...	2·41	3	1·99	3·0
6th do. ...	...	...	·01	·3	33rd do. ...	2·44	2	1·93	3·0
7th do. ...	...	...	·06	·3	34th do. ...	15·69	7	2·76	3·8
8th do. ...	...	...	·09	·4	35th do. ...	10·59	4	3·60	3·2
9th do. ...	...	...	·16	·4	36th do. ...	3·58	2	3·74	2·3
10th do. ...	...	...	·67	1·1	37th do. ...	1·56	1	·93	1·6
11th do. ...	1·25	1	1·11	2·5	38th do. ...	2·08	2	·20	·9
12th do. ...	·16	1	·53	2·1	39th do. ...	...	...	·31	1·7
13th do. ...	...	...	·49	2·7	40th do. ...	...	...	·03	·4
14th do. ...	...	...	·40	2·0	41st do. ...	...	...	·00	·2
15th do. ...	·58	2	1·77	3·0	42nd do. ...	...	...	·58	·4
16th do. ...	·29	2	1·03	3·0	43rd do. ...	...	...	·48	·4
17th do. ..	...	...	1·07	2·7	44th do. ...	...	...	·20	·2
18th do. ...	2·76	3	1·22	2·6	45th do. ...	6·23	4	·08	·2
19th do. ...	3·86	4	1·45	3·5	46th do. ...	...	...	·02	·1
20th do. ...	·30	2	·61	3·0	47th do. ...	...	...	·12	·1
21st do. ...	·82	1	1·15	2·2	48th do. ...	...	...	·06	·1
22nd do. ...	1·25	2	1·16	2·9	49th do. ...	...	...	·09	·3
23rd do. ...	·12	1	·81	2·7	50th do. ...	...	...	·06	·3
24th do. ...	2·53	2	·70	2·4	51st do. ...	...	...	·00	...
25th do. ...	1·71	2	1·41	2·6	52nd do. ...	...	...	·00	...
26th do. ...	...	...	·70	1·9					
27th do. ...	·79	2	1·22	1·8	Total ...	86·17	62	44·80	80·6

4. On comparing the two tables it will be seen at a glance how differently the results are brought out. The first table affords no information whatever regarding the peculiar character of the season, beyond the information that the rainfall was more than usually excessive. From the monthly returns it might readily be supposed that during the first three or four months of the year the weather experienced was favorable to agriculture; but this was not so, as will be seen on referring to the other table; for during the first 14 weeks of the year there were only three weeks during which any rain fell, and the same may be observed on comparing the returns in each table for the last three or four months of the year. There is nothing in the monthly returns showing that the weather experienced was in any way unfavorable, yet on referring to the weekly returns for the same period, it will be observed that after the 38th week up to the end of the year, there was only one week in which any rain fell. I have frequently been surprised, on learning from reviews of ordinary meteorological registrations, that the weather experienced during a certain period was favorable to agricultural operations, when my own experience and knowledge of the country, convinced me that the very reverse was the case. If the average annual rainfall of a certain month is, say, 6 inches, and in that month a fall of 8 inches should be registered, it is at once concluded that the season experienced has been unusually favorable, whereas, the rain may all have fallen in the early part of the month, and the latter portion may have been characterized by a severe drought. Too much dependence is placed on the monthly rainfall in this country; if people will not take the trouble to investigate detailed registrations, then the only safe course is to make up the rainfall registrations weekly, instead of monthly.

5. Ordinary weather was experienced in April; and little was attempted in the way of cultivation. In the early part (first three days) of May a severe cyclone visited the district, and did a great amount of damage to buildings, trees, and crops on the Sydapet Farms. The trees injured were chiefly mangoes; some were torn up by the roots, while others lost many large branches; and the fruit crop, which was then on the trees, was entirely lost.

The cashew-nut crop was also destroyed. Several hundred plantains, just in bearing, on the Model Farm, were blown down and rendered worthless. During the three days over which the storm prevailed the rain gauge registered 7·55 inches, and the river Adyar was much flooded. The land having been thoroughly soaked, advantage was taken of the opportunity to resume ploughing operations which the long drought had stopped, and a large area of land was sown with cumboo for green crop; but, as there was no more rain in May, and only a couple of showers in June, nothing resulted from these sowings, and the greater portion of the land had again to be sown in July. The weather experienced in August and September was favorable to field work, and much progress was made in getting ready the soil for the regular cold weather crops, and before the end of September a considerable area of land was sown with cotton, maize, sorghum, cholum, &c. During the period between the beginning of October and the middle of November the weather was very favorable for growing crops, so much so that they grew with great luxuriance; but, unfortunately, this luxuriance of growth was all against them during the heavy storms of rain and wind which occurred between the 16th and the end of the month, in which period the amount of rain registered was 28½ inches. Had these storms occurred about the end of October, the usual season for them, little damage would have been done to growing crops, especially to cholum, maize, &c., which would have been only a few inches above ground; but when the heaviest part of the monsoon broke over the district these crops had reached several feet in height, and were in a state peculiarly liable to damage from wind, &c., to which their succulent rapidly-grown stems could offer no resistance. From the causes just noticed a large proportion of our most promising crops were rendered unproductive, and most of the crop experiments that were in progress were thus abruptly ended without any result having been obtained. The late sown crops, which of course had suffered less from the stormy weather in the end of November, produced but indifferently, as, after the 19th of December until the end of March, there were but four days on which rain fell.

6. I am now fully convinced that to secure average results in farming in this country, which suffers alternately from floods and from drought, we must both subsoil-drain, and irrigate; it is only by these means that we can produce anything like an equilibrium in the results of our farming operations. It may be said that both are expensive means to set in operation, and undoubtedly they are, if judged only from the value of the results obtained, during the next two or three years after their first employment; but, if the results secured over a lengthened period are carefully estimated and valued, it will be ascertained beyond all doubt that capital so invested is most advantageously employed.

7. *Tours and Inspections.*—At the request of the Chief Commissioner of Mysore, I was directed, in Government Order No. 956, dated the 21st of June, to proceed to Mysore, to advise in the selection of a site for a Government Farm in the Nundidroog Division. I left for Bangalore on the evening of the 4th of July, and reached Madras again on the morning of the 10th. I again left Madras on the 24th of the same month, under the instructions of the Board conveyed in their Proceedings No. 939, dated the 8th of June, to inspect a site near the village of Sirigoopa in the northern part of the Bellary District, which had been selected by the Collector for the District Farm. After performing this duty, I again returned to Madras, which I reached on the 28th. In a letter No. 729, dated September 24th, 1872, I reported to the Board my opinion regarding the suitability of the Sirigoopa site. I remained in Madras until the 2nd of October, when, under instructions conveyed in Board's Miscellaneous Proceedings No. 5,932, dated 27th of August 1872, I left Madras for Ootacamund to complete my inspection of the Neilgherry District, in view to the preparation of the report called for in Government Order No. 1,658, dated September 22nd, 1871. Having performed this duty as far as the little time at my disposal and the state of the weather permitted, I again returned to Madras, which I reached on the evening of the 4th of December. On my way up to the Neilgherries I stopped at Coimbatore and inspected two blocks of land which had been recommended as suited for the requirements of the projected Central Farm of this district. In my letter to the Board, No. 176, dated the 7th

of March, I reported my opinion regarding the fitness of the land for use in the way suggested.

8. *Office Work.*—In my last report I directed attention to the large increase in the office work of this department, consequent on certain changes made during the year then under review, in its position and duties. Not only was this increase maintained throughout the past year, but the character of the work has so materially changed, that it demands much greater personal attention from me, being now chiefly official correspondence, no inconsiderable portion of which is with the Board of Revenue. The difficulty of keeping pace with these extra demands on my time, was greatly increased by my frequent absence from Madras on duty, as I had no one competent to carry on the more important work of my office during my absence; the result is, that arrears of office work have accumulated, which it will be impossible to clear off, until I have an assistant competent to aid me and able to conduct my office work when I am absent on duty. The late submission of this report is, I regret, one result of this unsatisfactory state of affairs. Much credit is due to my Head Clerk, P. Valoyutha Naicker, for the very satisfactory manner in which he carried on the routine work of my office, during the periods I was absent on tour, work of an unusually responsible and troublesome nature, from the frequent references that had, through him, to be made to me, for instructions on all sorts of matters connected with the management of the farms at Sydapet, &c., &c., and from he being the channel through whom these instructions were conveyed to those concerned.

9. *Educational Work.*—Nearly the whole of the work of this department during the past year might fairly be reviewed under the above heading, as it was undertaken chiefly with the view of promoting agricultural knowledge; but in the remarks that will follow I intend to refer only to our direct educational work in training agricultural apprentices.

10. There are now at the Sydapet Farms two classes of apprentices. The longest established of these classes includes only Sydapet Farm Apprentices; of these there are six, each in the receipt of a monthly allowance varying in amount from Rupees 15 to Rupees 20 with free quarters on the farm. This class was begun some years ago, but no formal sanction having been obtained for the expenditure of money in its maintenance, it became necessary that sanction should be obtained, and this was given in Government Order No. 1,041, dated the 13th of June 1871. Under the terms of this order, the entertainment of 6 apprentices at Rupees 15 per mensem, with a yearly increase of Rupees 2½ (on condition of good behaviour) for four years, rising to Rupees 25 per mensem in the fourth year was sanctioned. There are both Eurasians and Hindus in this class, usually three of each; the former are generally the sons of old soldiers who have taken up their residence at St. Thomas' Mount or in Palaveram. These youths are, generally, active and intelligent, and they are in most instances fairly educated. A few lads, of a similar class, were obtained from the Military Orphan Asylum in Madras, however, with the exception of one, they remained at the farm but a short time. This result is to be attributed rather to the injudicious interference and advice of their relatives than to any defects in the capabilities of the lads. The Hindu youths are obtained from the villages in the neighbourhood of the Sydapet Farms. In most instances they are lads who have obtained their education in the Hindu High School, which is situated in the neighbourhood of the Experimental Farm, and they are generally the sons of ryots. There are always many applications for any vacancy that may occur in this class. In selecting young men for employment as Sydapet Farm Apprentices, it is usual to choose those who appear to possess the best physique, and who produce the most favorable testimonials as regards character, &c., and then to subject those thus selected to a competitive examination in writing from dictation and elementary arithmetic. All the youths in this class are regularly employed in the ordinary work of the farm. During the first and second year in this class they are engaged in manual employment in the same way as the regular field hands; but if before the expiration of the second year, any lad is found to possess the

necessary qualifications, his services are at once utilized. Those who have thus been in the class for two years, and those who are found competent, are employed each with a gang of field laborers, over whom they exercise a limited control under the Overseers, who in the morning lays off the work to be done during the day, and in the evening inspects what has been done, thus the apprentices have the means of ascertaining practically, what constitutes a fair day's work in the different employments on which field hands are usually engaged. These apprentices, employed with field hands, are expected to take part in the work, whatever be its nature, on which the men are engaged. The more advanced apprentices usually take it in turns to be Store-keeper at the Experimental Farm, and the youth so engaged, is thus afforded an opportunity of making himself familiar with the different matters that engage attention at the farm buildings, and with the work that is being done in the Implement Workshops. Though the young men in this class have thus ample opportunities of seeing and taking part in all that is done on the farms, they have not generally availed themselves of these advantages to the extent that is desirable. They certainly learn to copy what they see done on the Sydapet Farms, and they will probably pick up during their apprenticeship enough information to enable them to conduct successfully a small farm of their own, if its circumstances are not unlike those of the farms at Sydapet; but the lads trained under such a system can never be usefully employed in the districts in spreading agricultural knowledge, or in conducting agricultural operations except those of the simplest kind. It is true that the Overseers in charge of both the Experimental, and the Model Farms at Sydapet, have been trained under the system I am condemning, and both are useful men in any position such as they now occupy, and under circumstances something similar to those in which they are now placed, but for each of the apprentices who have turned out fairly satisfactory, there were a dozen who have done otherwise. Mere field training will never fit a man to go into a new district to aid in introducing amongst its cultivators a better agricultural practice. Such training must be supplemented by theoretical teaching in the class-room and in the lecture-room; under a definite system which will test the progress made from month to month. Under the present arrangements as long as an apprentice in this clsss conducts himself moderately well, he is allowed to remain in the class, though possibly he is making little use of the opportunities he enjoys for gaining agricultural information.

11. The other class was begun in December last. It was established under Government Order No. 1,657, dated the 22nd of September 1871, and was intended to provide the necessary agency for carrying on the District Farms. Four apprenticeships were at first established, but the number was shortly afterwards increased to six; to each apprenticeship is attached a salary of Rupees 40 monthly, with a free residence on the Experimental Farm. The Order directed that the youths were to be selected from the Coimbatore, Bellary, and Tinnevelly Districts, in which collectorates it was then intended to begin the first District Farms; it further directed that the youths should be chosen from the ryot class, or from some other class connected with the land; that they should be of an age between 18 and 20 years; should be strong and healthy, should possess a colloquial knowledge of English, and should be willing to enter into an engagement to serve in the Agricultural Department should their services be needed.

12. Some difficulty was experienced in meeting with young men for this class, possessed of the necessary qualifications. The salary offered was sufficiently attractive; but it was found that there were but few youths of the ryot class that were sufficiently well educated, in the districts from which the youths were to be selected. Had there been no limit as to district, there would have been no difficulty in securing a large number of suitable young men for the appointments, even at a salary only half the amount offered. I have arrived at this conclusion from the experience I have had when vacancies have occurred in Sydapet Farm Apprenticeships, for the youths that apply for these vacancies are in most instances as closely connected with the ryot class, are of as good a social

standing, and are frequently much more highly educated than the youths that now fill the District Farm Apprenticeships.

13. No suitable persons having been secured in Tinnevelly for the appointments, they were filled up from the following districts as follows; from Bellary 2, one a Mahomedan and the other a Hindu; from Coimbatore 3, all Hindus; from Ganjam 1, a Hindu; in addition to these, a young man from Vizagapatam sent by, and paid by His Highness the Maharajah of Vizianagrum, K.C.S.I., was received under similar regulations. All were appointed on probation; they joined their appointments during December and January. In February one of the Coimbatore men was allowed to resign his apprenticeship and return to his home, as the state of his health was so unsatisfactory while he resided at Sydapet: and another apprentice from the same district was sent home in March, as he was found quite unfitted for an agricultural training. There were thus at the close of the year only five in this class, including the youth from Vizagapatam.

14. The following table shows how these apprentices are employed on each working day:—

	A.M.		A.M.	
From	5-30	to	8	—Field work on the Experimental Farm.
From	8	to	9	—Breakfast.
From	9	to	11	—Studying in the reading-room.
			P.M.	
From	11	to	2	—Off duty, dinner, &c.
	P.M.			
From	2	to	3	—Field work on the Experimental Farm.
From	3	to	4	—Studying in the reading-room.
From	4	to	6	—Field work on the Model Farm.

Though these apprentices are not put to actual work like the Sydapet Farm Apprentices, they are expected to take part in what is going on at the farms, and to make themselves acquainted with the object with which the work is being done; they are also expected to be able to work any of the implements and machines used on the farms. Each has to keep a Farm Journal, in which he enters daily all the various employments on which the men and cattle are engaged. Examinations are occasionally held, in view to determine whether the apprentices are doing their duty. At the last examination the following paper was set:—

EXAMINATION HELD ON THE 22ND AND 24TH OF MARCH 1873.

Paper Examination.

	Full Marks.
1. I paid a cooly in the month of January Rs. 2-12-11. His pay is Rs. 3 per month. For how many days did he receive pay? ...	15
2. I sowed on $2\frac{5}{8}$ acres of land 28 lbs. of indigo seed. How many pounds did I sow per acre?	15
3. A plough turns over a furrow slice 6 inches in width, the cattle travel at the rate of 2 miles per hour; tell me how many square yards of ground will be turned over during a working day of 8 hours, deducting 20 per cent. of the time for turnings? ...	15
4. The bucket at the whim contains 30 gallons of water, 60 buckets are raised per hour, the diameter of the bullock walk is 12 feet. The bullocks make 2 revolutions of the walk for each bucket raised. Tell me how many gallons of water are raised in a working day of 8 hours and what distance the bullock travels to perform this work?	15

Vivâ voce Examination.

	Full Marks.
1. A number of ordinary country grains to be named	10
2. Samples of wool. Information asked regarding the quality of each and how hair is recognized in a sample of wool?	10
3. Model of an improved plough and of a native plough. Information asked regarding the construction of each, and how this difference affects their working capabilities	10
4. Questions on Farm Map to ascertain apprentices' knowledge of the situation of different fields and of the boundaries of the estate	10
Total ...	100

The highest number of marks obtained was 63 and the lowest 51.

15. The general conduct of these young men while at the farm has been satisfactory, and they evince some interest in their duties, especially in those of a practical kind; all are able to work our English ploughs; indeed, two or three can plough very well. But the system is certainly not one that is calculated to train Superintendents to be placed in charge of the District Farms. These young men come here ignorant of the very A B C of agriculture, and agriculture can be taught, only in the way that any other profession is taught, by beginning first with systematic elementary instruction and grounding the student thoroughly as he proceeds in his education. The system under which these young men are supposed to be taught agriculture, is that under which agricultural pupils are placed on a farm in England. But little consideration is needed to enable one to see that such a system, even if beneficial in England, can only be so under conditions which are not met with in this country. In England young men who are placed for a time with a farmer to learn practical farming, generally spend a year or more at some institution devoted to the teaching of agriculture, or the sciences bearing on agriculture; and the superior practice which they are thus taught is a novelty, but in very few districts of the British Isles, so that they have generally in the locality in which they begin actual farming, one or more practical illustrations of what they want to achieve. How different will be the case with our District Farm Superintendents? They will have to introduce a practice which all their neighbours may at first be inclined to oppose with the utmost of their ability, which may even be opposed to the traditions in which they themselves have been trained. Some of these young men may in time, under the training under which they are now placed, become suited for employment as overseers under certain conditions, and might also under certain conditions make successful farmers, but they can never become what the District Farm Superintendents should be—local centres of agricultural information, local authorities on all relating to the agricultural practice of the districts, and the pioneers of agricultural reform.

16. *Distribution of Seeds.*—In the Proceedings of the Board of Revenue, No. 4,956, dated the 7th of December 1871, it was directed that, after the distribution of the Carolina paddy seed then in stock, that Collectors should pay the full market-value of any seed they required from the Experimental Farm, with the cost of packing, conveyance, &c., and the same regulations, slightly modified, were brought to bear on applications received for seeds from private persons. For these reasons, only the following small quantities of seeds were issued gratuitously during the past year:—

	Pounds.
Cotton Seeds	683
Carolina Paddy Seed	90
Sorghum Saccharatum Seed	402
Maize Seed	301
Yellow Cholum Seed	35
	1,501

17. *Ploughing Competition.*—A ploughing match was held on the Experimental Farm in December. As it was the first public competition of the kind ever held in this Presidency, it created a good deal of interest, especially amongst the cultivators that reside in the neighbourhood of Sydapet, who visited the farm in great numbers during the competition, and seemed to be much interested in what was going forward. Their Excellencies Lord and Lady Hobart, the Hon. J. D. Sim, C.S.I., and most of the influential gentlemen—Europeans and Natives—of the district were present to witness the competition.

The following gentlemen were good enough to act as Judges :—

Class A.	Class B.	Class C.
Dr. Bidie.	The Hon. Major Bourke.	Colonel Benson.
G. Thornhill, Esq.	J. C. Loch, Esq.	R. A. Dalyell, Esq.
Colonel J. P. Watts.	T. Pritchard, Esq.	Dr. Hunter.
M.R.Ry. T. Muthusawmi Iyer.	M.R.Ry. R. Ragoonatha Row.	The Hon. J. D. Sim, C.S.I.
M.R.Ry. T. Chentsal Row.	M.R.Ry. Hurry Row.	M.R.Ry. Vijia Ragavaloo Chetty.

Only iron ploughs were allowed to compete in Class A; ploughs made partly of wood and partly of iron and all descriptions of native ploughs competed in Class B; and Class C was open only to ploughs worked by Farm Apprentices. The competitors in each class had each to plough a plot of ground measuring 600 square yards. The soil was a free sandy loam. Four prizes were offered for competition in each class. The prizes were awarded for (1) depth, (2) regularity and straightness of furrow, and (3) speed in executing the work; perfection in each of these was valued at 25 points, and the prizes were given to the ploughmen in each class who obtained the highest aggregate of points. During the competition, besides the ploughmen only the judges were allowed to enter the field; as it was feared that, if strangers were permitted to go near the cattle while ploughing, the execution of the work would be imperfect from the cattle becoming unmanageable.

18. The results of the competition were as follows :—

Names of Competitors.	Time occupied in completing work.	Equal to work done in a day of 8 hours.
	Minutes.	Acres.
1. Muthoo ...	31	1·91
2. Cunthen...	45	1·32
3. Annamalay	45	1·32
4. Iyulu ...	50	1·19
Thosery...	52	1·14
Murugan	62	·95
Morry ...	Stopped; cattle unmanageable.	

The competitors in this class were all field laborers employed on the Government Farms. The winners of the first, the second, and the third prizes worked ploughs made by Messrs. Ransomes and Sims, of Ipswich, England; the man who gained the fourth prize also worked a plough of a similar kind, which had been made in this country; Murugan and Thosery worked ploughs made by Messrs. Howard and Co., of Bedford, England; the plough used by Morry was made in America by Messrs. Ames and Co., of Boston. I do not attach much importance to the fact that the men who used Messrs. Ransomes and Sims' ploughs stood highest in the competition, as I believe the ploughs used that were made by Messrs. Howard and Co. were as good as any in the field: the difference in the results obtained were, I think, due chiefly to the different capabilities of the men and their cattle. The whole of the work done by the competitors in this class was very fairly performed; the average depth of the ploughing was about 6 inches.

Of course the speed at which the ploughs were driven was beyond the speed at which they are usually worked, but the judges were present in the field during the whole time the competition was proceeding, and checked all attempts to over-drive the cattle.

19. There were a large number of competitors in Class B, the greater number being ryots from the adjoining district. The work done was generally poor in comparison with that performed by the iron ploughs; and neither was it completed so quickly, for nearly half the number of iron ploughs had finished their allotted task before a single plough in this class had finished. Three of the prizes in this class were carried off by men who used combined ploughs which had been made in the Implement Workshops at the Experimental Farm. The other prize, the third, was awarded to a cultivator from the neighbourhood of Guindy, who used a country plough of rather a better shape than that usually employed.

20. For the prizes in Class C there were six competitors—all Sydapet Farm Apprentices. The work done by them was not so good as I expected, but the judges and spectators expressed themselves highly pleased with what they did. They were certainly placed in very trying circumstances, as, until they came into the field to begin work, none knew what cattle or what plough it would fall to his lot to compete with, as both plough and cattle were drawn by lot. The two Hindu Apprentices who carried off the first and the second prizes, were both educated at the Sydapet High School, at which institution the winner of the first prize had taken a very creditable position. Apprentices McManus and Gale, the former of whom gained the third prize and the latter the fourth prize, did creditable work, but they did not manage their cattle well.

SYDAPET EXPERIMENTAL FARM.

Estate Improvements.

21. *Cottages.*—On a piece of waste land situated, a few hundred yards to the west of the Experimental Farm buildings, six cottages have just been erected for the occupation of the apprentices who are required to live on the farm; the situation of the cottages is convenient, being so near to the farm buildings and yet unconnected with them; thus, while a certain amount of privacy is secured to the occupants of the cottages, they are yet under proper supervision. Each cottage is provided with a cook-house and other conveniences, the whole being placed in an enclosed garden. The walls of all these buildings are made of well-burned bricks, the portion below ground consists of brick built in lime, and the portion above ground of brick built in mud, excepting about a foot in depth immediately under the roof, which consists of bricks built in lime. The roofs are all tiled on palmyra rafters and reepers. The walls are plastered inside and pointed on the outside, and the floors are paved with square bricks. The whole of the work has been done in a substantial manner. The materials were purchased; and the labor was performed under the following contract rates:—

Building brick walls in mud, 3 pies per cubic foot.
Do. in lime, 6 pies do.
Building brick arches, in lime, 1 anna do.
Roofing with pan-tiles and flat-tiles with plaster border, Rs. 1-4-0 per 100 square feet.
Plastering two coats, Rs. 1-6-0 per 100 square feet.
Pointing outside, „ 1-4-0 do.
Flooring with square tiles, Rs. 0-14-0 do.

These rates have been in force for some time on the Sydapet Farms, and they are, I think, reasonable considering the kind of materials the workmen have to work with in this part of India. I have tried the effect of giving to contractors the whole of the work instead of only labor; but I have not found this plan answer; it is I find decidedly the best way to

contract separately for labor, and for the materials required. Bricks and tiles I can usually purchase at a fair price in the neighbourhood and around Sydapet: the following are the rates paid:—

	Per Rupee.
Bricks (first and second sorts only)	371
Pan-tiles do.	514
Flat-tiles do.	543
Flooring tiles 8″ × 8″ (first sort only)	100

The foregoing are the rates at the kilns, which are situated about a mile from the Experimental Farm. Both bricks and tiles are very inferior in comparison with those that are made in England, while they are only about two-thirds the size. Chunam (shell lime) is supplied unslacked at about two parahs per one rupee, or slacked at about 3½ parahs per rupee, delivered in either case. The parah contains about 4,000 cubic inches. Palmyra rafters 10 feet long can usually be bought in Madras at the rate of eight for Rupees 3½, and reepers of the same wood at Rupees 6 per hundred of about 10 feet in length. Teak wood sawn varies from Rupees 2¼ to Rupees 3 per cubic foot; in the log it can be bought at from Rupees 2 to Rupees 2½ per cubic foot. I have given the foregoing details, as I am so frequently asked the cost of putting up farm buildings. It will be noticed that the cost of erecting farm buildings in this country is very high, in comparison with the cost that must be incurred in other countries, in which there are no white-ants to fear. The most serious item in the cost is teak wood, which is really necessary in some parts of the buildings, though its use is generally restricted as much as possible. On most English estates there is generally enough wood growing, of a kind suited for the requirements of any buildings that are to be erected, and it is not necessary in that country to pay from 5 shillings to 6 shillings per cubic foot for building timber. We sadly need a cheap description of wood that will resist the attacks of white-ants in the way teak does. We must secure a certain degree of permanency in our farm buildings. These quickly run up structures composed of bamboos, leaves, &c.; are a source of endless expense; their first cost may seem low, but, in the long run, when it is necessary that they should be kept up, they are most expensive structures.

22. *Poultry House.*—The poultry-house having been very inconveniently placed, it was taken down and was built on a site situated nearly in the centre of the Farm Steading. The materials in the old house were utilized in building the new one, the walls having been of brick in mud, the bricks were readily removed without damage. In re-building the house, the internal arrangements were rendered more suited for the accommodation of fowls undergoing gradual acclimatization.

23. *Subsoil Draining.*—Before I had been twelve months in this country, I had become fully convinced that in the districts over which my observations extended, agriculture suffered far more from an excess of water than from a deficiency of water, and the experience I have since had in conducting the operations of the Sydapet Farms, and the observations I have made during my tours over the Presidency, fully confirm the opinions then formed. I have refrained until now from bringing this matter forward in a prominent way, from a desire to gain as much information as possible regarding the influence of seasons of various characters. I am not unaware of the unmerited ridicule with which the advice of a distinguished agriculturist was received some years ago in this Presidency, when he ventured to advise our ryots to drain their paddy fields. Speaking generally, that advice was perfectly sound, and I have not the least doubt but that, had it been generally adopted, the country would have been richer by some millions of rupees than it now is. Irrigation and drainage must proceed together; the vast expenditure the State has incurred on irrigation works will never produce a fair return, until the districts so watered are properly drained. The almost perfect irrigation arrangements of some districts is, under present circumstances, so much against these districts. The command of an abundant supply of water throughout the year is the very reason why, in the neighbourhood of some of our best irrigation

works, there is now so much, otherwise valuable, land abandoned. When the old-fashioned and imperfect means of irrigation only existed, with but a four or six months' supply of water, the land had annually from six to eight months, during which it might recover from the ill-effects of swamp cultivation. The irrigation works in many parts of the Presidency are too far ahead of the intelligence of our ryots, who will not utilize the advantages they possess, by *moderately* irrigating their land, but will persist in inundating it, and in so doing converting it into a marsh fit only for the production of indigenous paddy, and of low type crops with a semi-aquatic habit of growth, and with these crops the land is sown again and again, until it is rendered unfit even for their growth, when it is abandoned and turned over to the State. Thus the very advantages which we are so anxious to place at the disposal of the ryot are used by him, from want of judgment, in such a way as to produce disease and death in his neighbourhood, his own bankruptcy, and a great financial loss to the country. If it is the duty of the State to provide its tenants with the means of irrigating the land they occupy, it is equally its duty to see that proper drainage arrangements are made, so that the irrigation water they provide, may not collect and stagnate in the soil to its injury, and to the injury of the health of the people who reside in the neighbourhood of land so irrigated. But, while a large tract of country has thus been rendered unproductive, by the abuse of irrigation in the absence of proper drainage, there is still in this Presidency a far wider area of country that is injured by natural means, through an excess of water from rainfall or other causes. Not only does such water on retentive soils, greatly retard field operations at the season when such work yields the largest returns, but it prevents the free use of superior field implements, renders it impossible to adopt superior methods of cultivation, and confines the cropping of the land to the lower class of crops. How frequently it happens, during September and October, when it is so important that every hour should be utilized for getting in the cold weather crops, that a heavy fall of rain puts an entire stop for days to all field operations on our retentive soils, by making the land unfit to carry cattle and implements, until by evaporation it is again rendered sufficiently firm for the cultivating operations to be proceeded with, from this cause. I have frequently been obliged, when in the midst of work, to abandon further preparations and leave the land uncropped until after the rains, in this way frequently losing something like 10 rupees per acre, the difference between the probable value of a crop produced from seed sown after the rains, and of a crop sown under proper conditions before the rains. The great desire of the intelligent cultivator is to commence operations on his soil, as soon as possible after the rains first begin, and to get it cultivated and sown without loss of time, in order to secure the full advantage of the growing weather for starting his crops. On a good deal of the stiff land of this Presidency, nothing can be done in working the soil until a week or more after a heavy fall of rain, and frequently by the time that the land is in a state fit for being worked, the weather has undergone a complete change, the air has become dry, and the sky clear and cloudless, conditions anything but favorable for the success of newly-sown crops. On the other hand, similar land when properly drained will generally be fit for undergoing preparation within a day or two after a heavy fall of rain. Not only does an excess of water in a soil of a retentive character, prevent the cultivators of such soils from taking full advantage of seasonable rains for getting in their crops, thus delaying and putting out of season all subsequent operations, but a large proportion of the seed sown under such conditions invariably perishes, and another considerable proportion yields only undersized sickly plants, while the plants produced by the remainder yield but very poor returns; they have so much to contend with during growth from weeds, which the wetness of the ground, prevents being regularly removed by the bullock-hoe or hand-hoe; from the absence of aëration in the surrounding soil, from inability to work the cultivators satisfactorily in a wet soil; from the attacks of insects, and from fungoid diseases, mildew, rust, &c., which delight to feed on crops that are growing under unfavorable conditions. In pointing out the evil consequences of an excess of water in an arable soil, I do not forget that, in this country, much loss often results from the contrary condition—a deficiency of moisture in our soils—but as an agriculturist I should

much prefer to be the cultivator of land, on which the crops occasionally suffered from drought, than to be the cultivator of land liable to be injured by an excess of stagnant water. However, it is possible to meet with a soil that suffers occasionally from both these extremes; indeed, this is a very usual experience with retentive undrained soils. During a drought, the crops on the undrained soils are far more likely to suffer from the drought, than the crops on a similar soil that has been properly subsoil-drained. At such a time undrained soils are caked over, are hide-bound, and full of cracks, while the drained soils are loose and friable, conditions suited for the absorption of dew and watery vapor during night, while the whole body of the tilled soil being more or less porous, it holds water readily in mechanical suspension; and, as the roots of the plants growing on such a soil meet with no obstacle to their free passage, but rather encouragement to their growth, they naturally grow deeper into the soil, and are thus better protected from the hurtful influence of a scorching sun. While this much is certain, there yet remains a wide field for investigation in connexion with subsoil drainage in this country, as we have here to contend with conditions so widely different from those met with in those parts of Europe where yet only subsoil drainage has been tried on an extensive scale. The matter is one which needs to be examined from various stand-points, and one that well deserves our most serious attention; experiment should be instituted under all the various conditions met with in the cultivation of arable land in this country, and the results should be carefully recorded and compared. I have just begun a small experiment in subsoil drainage, but it was commenced so recently that I can now do little more than describe the preliminary operations and indicate the direction in which it seeks for information. The field selected for the experiment measures 3·80 acres; it is divided by a water channel nearly in two equal-sized portions. The soil is a stiffish loam, of a sour soapy character, resting on a subsoil of a similar nature, and it has been almost quite unproductive during the five years I have been acquainted with it. The land was formerly (before it became the property of Government) used for growing paddy, under the repeated cultivation of which it had become injured. When heavily seeded, there was generally a fair covering of plant up to the time the crop was about one-third grown, and the plants looked well as long as their roots were confined to the few inches of the healthy surface soil; but after this, when the roots got into the sour soil, there was little further growth, the plants became yellow and stunted, and gradually red from the attacks of the fungoid disease, "Rust," and but an exceedingly small yield of inferior grain was obtained. It mattered not what crop was tried, the result was generally the same. It is intended that one portion of the field shall be drained with stone-drains, and the other portion with pipe-drains, each portion being separately provided with a main drain and an outfall. On both plots the parallel drains will be 3½ feet deep, and the main drain four feet deep, while the distance between each parallel drain will be 24 feet. The cutting of the parallel drains has been let to a contractor at 3½ rupees per 200 running yards; he merely makes the cutting and throws the earth on the sides of the drain; each drain will be 18 inches wide at the top and nine inches wide at the bottom; this is, of course, much wider than is necessary and much wider than I intended; but I found, after a day's experience, that the laborers here could not work the ordinary English draining tools, and no choice was left to me but to allow the contractor to excavate the drains in his own way by means of the ordinary crowbar, mamuttee, and basket, hence the necessity of cutting the drains so wide. Our laborers have not the muscular power necessary to admit of their using ordinary drain tools; however, it is, I think, possible to prepare tools specially suited to them, with which they may cut drains without having to make the excavation so wide as is necessary with the tools now used. The stones needed for the stone-drains are being quarried on the Experimental Farm; for raising them and breaking them to a size sufficient to pass through a ring with a diameter of three inches, the cost is about four pice per parah (4,000 cubic inches) of broken stones; these stones will be laid in the parallel drains to the depth of one foot, and in the main drain to the depth of about one and a half feet. It is possible that, with further experience as the work proceeds,

we may be able to reduce these charges; but, taking them as a basis for calculating the probable cost of draining with stone-drains, the cost per acre will be as follows:—

	RS.	A.	P.
Cost of cutting parallel drains, say, 580 running yards, at 3½ rupees per 200 running yards	10	2	5
Cost of cutting, say, 58 running yards of main drain, building outlet, and providing a grate...	4	8	0
Cost of broken stones for 580 running yards of parallel drain.	13	11	4
Cost of broken stones for 58 yards of main drain	2	5	4
Cost of carting broken stones from quarry to field, 8 days for 1 cart and driver, at Annas 12 per day...	6	0	0
Cost of putting stones in drain, filling in earth, &c.	5	0	0
Total...	41	11	1

It is not so easy to estimate the cost of pipe-draining, as in this country there has not as yet been any attempt to make pipes for agricultural use, and it is exceedingly difficult to get natives to begin any new industry. I have tried our local tile-burners again and again, but they will not undertake the manufacture of pipes excepting at a price that quite prohibits their use for field draining. We must, therefore, manufacture them ourselves on the Experimental Farm; this I intend doing, and at present I see nothing to prevent us making good two-inch pipes at, say, Rupees 12 per 1,000. This rate is above the average price in England; the difference is due to the extra cost of fuel in this country. If we can but get coals delivered at something like the cost of coals in most English tile-yards, we could manufacture pipes at a lower price than they cost in England. Taking Rupees 12 as the probable cost per thousand, the expense of draining an acre of land here with two-inch pipes would be something as follows:—

	RS.	A.	P.
Cost of cutting parallel drains, say 580 running yards, at 3½ Rupees per 200 running yards	10	2	5
Cost of cutting, say, 58 running yards of main drain, building, outlet, and providing a grate	4	8	0
Cost of pipes for main and parallel drains, say, 1,700, at Rupees 12 per 1,000	20	6	4
Cost of carting pipes	1	0	0
Cost of laying pipes and filling in earth	4	0	0
	40	0	9

From these estimates it would appear that the probable cost of draining land by pipes and by stones would not differ greatly in this district. However, I strongly believe that when the manufacture of pipes is begun on an extensive scale, it will be found possible to supply two-inch pipes, at a price, at the least, 25 per cent. below the price that appears in my estimates. But I certainly greatly prefer pipes to stones even at equal cost; the pipes appear in every way to be better suited for this country. The experiment now being instituted will be carefully watched, and the observations made from time to time will be duly reported.

24. Persons who are unacquainted with agriculture, as practised in this country, can form no idea of the enormous losses that the cultivators of badly-drained land suffer in an unusually wet season. The money expended in draining an acre of land is soon recovered, indeed, on many soils I have no doubt but that the entire cost, with interest on capital, will be recovered in from 8 to 10 years. Probably the ryot could not raise the needful capital, but then the ryot is not expected to raise the capital for developing irrigation

schemes; as the State provides the capital needed for establishing the means of irrigation, so should it provide capital for draining the land, charging the ryot a fair interest on the sum so expended. I see no reason why the annual rent charge on land drained by the State should exceed Rupees 2 per acre, a charge the ryot can well afford to pay from the larger and more uniform returns he will obtain from his land after it has been properly drained. The estimates I have given of the cost of subsoil draining can, of course, be reduced by increasing the distance between each drain and increasing their depth, which with some soils may be desirable, while in some instances two or three drains cut judiciously as regards depth and direction might be sufficient to drain a plot of several acres in extent, the cost per acre for the subsoil—draining in this case not being probably one-fourth the sum mentioned in the estimates. I advocate the merits of no particular system of draining; the system to be adopted, the number of drains per acre, the depth of these drains, must each be determined by the peculiarities of the land to be drained. Though I have suggested that the State might drain the land and charge an annual rent charge, there is no reason why the ryot should not do the draining himself; the expenditure that is incurred for draining is almost entirely laid out on labor, and he, if he chooses, might himself earn the money so spent. It must be understood that in these suggestions I advise only the drainage of land which rests on a retentive subsoil, in which water collects and stagnates. There is undoubtedly a large area of arable soil in this country, on which subsoil-drainage could have no useful effect.

25. *Reading-room.*—A room in one of the sheds at the Farm buildings was fitted up as a Reading-room for the use of the apprentices and others connected with these Farms. It is well supplied with books, periodicals, and newspapers relating to agriculture. It contains a small collection of agricultural seeds, feeding stuffs, artificial manures, soils, &c., and a few models of water-lifts, implements, &c. The room is open daily from morning until dark. The apprentices are allowed to remove the books for reading under certain conditions, but they are not allowed to remove from the room the periodicals and newspapers. A list of the books, &c., added to the library during the past year appears in the appendix.

26. *Irrigation Channel.*—To provide the means for irrigating the land situated on the eastern side of the Experimental Farm, a deep channel was dug in connection with the River Adyar. The floor of the channel is about 3 feet below the surface of the river when at its average height, that is, level with the crest of the anicut. The water thus flows by gravitation to the portion of the Farm on which it is needed, where it will be lifted for use. The height of the lift varies in different parts of the channel from 9 feet to 12 feet. In excavating this channel a large quantity of black alluvial earth was obtained; indeed, we raised such a quantity of this valuable deposit that its value reduced very considerably the cost of making the channel. Some difficulty was at first experienced in protecting the banks from cutting, during heavy rains, but by planting them with guinea-grass this difficulty has almost been overcome. When first planted the grass did not thrive, as it was planted in the raw unaërated soil, but now that the soil has been weathered and mellowed by exposure, the grass readily takes root. Some time must necessarily elapse before the grass covers the banks uniformly, but when once covered little damage will be done by heavy rains, and the slopes of the channel will be usefully employed in growing fodder. I had intended to continue this channel further over the Farm, and to provide it with several branches, but the scheme now under consideration, which proposes to give the whole estate a channel connected with the Chembrambaukum Tank, renders this unnecessary; a scheme which, I hope, will be approved, as it will give both Farms a full command of water throughout the year. At present we are frequently greatly inconvenienced from not having a supply of water wherever needed when a drought suddenly sets in; valuable experiments in operation are thus suddenly stopped, and the time and money spent on them are lost. Besides, with a perennial supply of water under command over the whole of the estate, field experiments could be conducted during any part of the year, or even over a series of years if necessary. Under present arrangements, field experiments can only be conducted

during the rainy season, and it frequently happens that from the weather experienced at such times, the whole of the results of a number of experiments are rendered useless.

Live Stock.

27. *Cattle.*—The disease known as epizootic aptha, or foot and mouth disease, appeared amongst the working cattle in February last. It had prevailed for some time previously, amongst the cattle belonging to the district in which the farm is situated, and it is probable that it found its way amongst the farm cattle by some one of them having been in contact with one of the animals suffering from the disease. Sixteen animals were attacked and the whole recovered. The disease appeared in rather a mild form; the symptoms in most of the cases were hot mouth and horns, vesicular eruptions on the upper part of the hoof and between the toes; in a few instances there was in addition vesicular eruptions on the tongue and in the inner side of the mouth. There was very little fever in any of the cases. The animals, except those with sore mouths, did not appear to suffer much pain, though all had diminished appetites and got out of condition. In the treatment of the diseased animals the first object was to get them removed entirely away from the healthy stock; they were then placed under the care of a man set apart for the special duty, who, of course, was not allowed to go near the healthy cattle. Every care was taken to place the animals under as comfortable conditions as circumstances would allow; they were fed on succulent green fodder and soft nutritious food, such as steeped oil-cake, &c. They were frequently washed, and special care was taken to keep their feet clean. After washing, the feet of all, the animals were regularly dressed with a preparation, of which the following is the composition:—

Tar	1	half-pint.
Sulphate of Copper	2	ounces.
Turpentine	½	a fluid drachm.

This was applied over the surface of the hoof and between the toes, a piece of thin, soft rope being used to work the preparation thoroughly into the crevices in the hoof. For bathing the ulcerated parts in the inner side of the mouth the following astringent wash was used:—

1 pound of alum.
2½ quarts of water.

The solution was prepared by dissolving the alum powder in the water, which had been heated to about 100 degrees. Three of the animals were unwell for about three weeks, but the majority of those attacked recovered in about a fortnight. Under good treatment the animals soon regained the condition they were in, previous to the outbreak of the disease. Every care was taken by removing the bedding of the stalls, &c., to prevent the disease from extending, and the result was so far satisfactory that no further cases occurred, while the cattle on the Model Farm altogether escaped being attacked.

28. The oil-cake made from the groundnut, to which I directed attention in my last report, formed the chief food of the working cattle during the past year; a daily allowance of four pounds per head, with a full supply of fodder, has sufficed to keep the animals in good working condition. In proof that the work performed by the Farm cattle is not light, I place on record here the following facts:—Sundays excepted, the Farm cattle work daily in the cold season 9 hours, and in the hot season 8½ hours, that is, in the cold season they begin work at 6 A.M. and work until 10 A.M., when they are put into their stalls to feed and rest until 1 P.M., at which hour they are again yoked; they are employed until 6 A. M., when the labor of the day ceases; the animals are then placed in their stalls, where they remain until the following morning. In the hot season their working hours are somewhat different; thus, instead of beginning work in the morning at 6, they then begin work at 5-30, and in the afternoon instead of beginning at 1, they do not begin until 2 o'clock. These hours are shorter than is usual in this part of

India, though for a hot climate they are sufficiently long for both the cattle and their drivers. Before I adopted these regulations the working day on the Experimental Farm for the draught cattle was about 10 hours in length throughout the whole year; however it was seldom that the animals performed 10 hours' work; for, though they might be in the fields or on the roads for 10 hours, they were not actually employed during the whole time, and it is better in every way that they should be comfortably lying in their stalls during the extra hour or hour and-a-half of leisure, which the present regulations afford them, than be standing for a similar length of time on the roadside or on the head-lands. The changes made in the working hours of the cattle have proved satisfactory; the cattle are now in their sheds during the hottest part of the day, and they now perform more work in a day than under the old system, for *they are kept at work during the hours set apart for work.* The amount of labor performed in a day by a pair of these cattle with European implements is—

	Acres.
In ploughing stubble land 4 to 6 inches deep	½
In ploughing fallow land 4 to 6 inches deep...	¾
In harrowing, with a set of iron seed harrows, once over ...	5
In harrowing, with an iron drag harrow, once over	3
In rolling, with a wooden roller, once over	5

In carting, the cattle are expected to travel about two miles an hour when drawing loads of from 1,000 to 1,200 pounds.

When working the bullock powers either "under" or "overhead" in raising water, cutting chaff, &c., they are made to travel about two miles per hour throughout both yokings, the actual draught per bullock varying, according to the nature of the work, from 50 to 100 pounds. This evidence is, I think, sufficiently conclusive as to the value of groundnut oil-cake as a food for draught cattle, and it fully confirms the good opinion formed of the cake from the results of its analysis. Unfortunately for those who have to purchase the cake, its price has been considerably increased during the last few months; thus, in our own case, during the past year we were supplied under a contract at the rate of Rupees 5-8-0 per 500 pounds delivered; but in contracting for a supply for another year, I have been obliged to agree to give Rupees 6-12-0 per 500 pounds, as we purchase 120,000 pounds per annum, this represents an increased annual expenditure of Rupees 300 for cattle food. I protested against this increase in the price, advertised for offers in all the cake-producing districts, and did my utmost to effect a contract on the old terms, but was unsuccessful. The cake manufacturers said that the demand for the cake had so greatly increased that they could readily sell at a good price to retail dealers in Madras all they could manufacture, and they had an impression that its price would still further increase. I would direct special attention to these facts; it is for reasons such as these that an experimental farmer, employed in the service of the public, never can, from a commercial point of view, be successful, for, all results his experiments bring to light, which may cost much time and money, are public property, and at once appropriated. I have again and again directed attention to the value of groundnut oil-cake, and what has been the results to the Sydapet Farms? Simply that the price of the cake has steadily increased, step by step, from about Rupees 4½ to Rupees 6¾ per 500 pounds, representing an increase of something like Rupees 500 per annum in the expenditure on account of these two Farms, equal to about Rupees 2 per acre. A commercial farmer would not have acted so, and would have pocketed these 2 Rupees per acre per annum. Being unable to effect a new contract in Madras, or in the districts around, on reasonable terms, I accepted the tender of a firm in Bangalore, and made a contract with them for a supply at the rate of 10,000 pounds per month, at Rupees 6-12-0 per 500 pounds delivered at Sydapet. Though the cake has thus increased in price, it is still by far the cheapest food for farm stock procurable in this part of India. In proof of this I give below the cost per day, on the Experimental Farm, of a pair of draught cattle fed on groundnut oil-cake.

	Rs.	A.	P.
Fodder throughout the year at the rate of 100 pounds per pair per day, valued at 400 pounds per rupee	91	4	0
Cake throughout the year at the rate of 8 pounds per pair per day, valued at Rupees 7 per 500 pounds	40	14	0
Interest on probable value of the pair of cattle, say, Rupees 150, at 5 per cent.	7	8	0
Deterioration, say, at 10 per cent. per annum, on Rupees 150, the value of the cattle	15	0	0
Shoeing throughout the year twelve times, at Annas 12 ...	9	0	0
Contingencies	6	6	0
	170	0	0

The total cost, Rupees 170, divided by 313, the number of working days in the year, gives a sum per day amounting to Annas 8 Pies 8 as the actual daily cost of a pair of these draught cattle.

29. For the reasons referred to in paragraphs 10, 11, 12, and 13 of my last report, very little was done during the past year in fattening cattle; and, until some of the difficulties noticed in these paragraphs are removed, I see little hope that farmers will find it worth their time to engage in fattening cattle for the market. A few feeding experiments were, however, made; from these I select the following: two small bullocks were put up to fatten; they were allowed daily six pounds of groundnut oil-cake and as much fodder as they chose to eat, which amounted to about 50 pounds daily. When this special feeding begun, the animals weighed together 690 pounds; they were weighed at the end of each week as the experiment progressed. The following are the weighings:—

	Weight of the two Animals. lbs.		Weight of the two Animals. lbs.
1st week	695	9th week	704
2nd do.	702	10th do.	710
3rd do.	728	11th do.	692
4th do.	719	12th do.	721
5th do.	...	13th do.	757
6th do.	...	14th do.	780
7th do.	...	15th do.	783
8th do.	701	16th do.	800

This experiment was spoilt by one of the animals having been attacked by the disease known as epizootic aptha, an outbreak of which amongst the draught cattle I have already noticed; though not a dangerous disease, it has a serious effect on the cattle it attacks, in causing them to lose flesh and get out of condition in a very short time. The weighings from the 4th to the 12th week were influenced by the cause just noticed; it will be observed that, after the animal had recovered, the weekly weighings showed a very satisfactory increase; thus, starting from the lowest weight recorded, that determined at the end of the 11th week, the results obtained are worth special notice:—

	Weight of the Animals. lbs.
11th week	692
12th do.	721
13th do.	757
14th do.	780
15th do.	783
16th do.	800

or, in 35 days an increase of 108 lbs. in the weight of the two animals ; estimating that this increase in their live weight would yield about 42 per cent. of beef, the proportion I have usually found the cattle of this country yield when fairly fattened, for each one hundred pounds of their live weight, the increase will represent about 45 pounds of beef, which at Annas 4 per pound, will be worth Rupees 11-4-0 : against the value of this increase we have the cost of feeding :—

	Rs.	A.	P.
Groundnut oil-cake for 35 days, at 6 lbs. per day, valued at 7 rupees per 500 lbs.	2	15	0
Fodder for 35 days, at 50 lbs. per day, valued at 1 rupee for 400 pounds	4	6	0
Attendance, &c.	0	11	0
Total ...	8	0	0

The value of the manure will more than equal the cost of the straw required for bedding, the value of the accommodation, &c. It would thus appear that during the last five weeks over which the experiment extended, a profit of about 40 per cent. on the cost of feeding, was obtained. But if the cost be estimated for the whole 16 weeks from the beginning to the end of the experiment, it will be found that the result was a very considerable loss. And thus it is, in farming, we cannot reduce the results of the operations we conduct, to the accuracy and exactness that is usual in ordinary trade or commerce ; it matters not how carefully we may plan, or with what skill we conduct the duties of our vocation, something is constantly stepping in the way to mar our prospects ; hence it so frequently happens that actual experience, produces results so much at variance with theoretical calculations, it is seldom that a large percentage over a series of years can be obtained on the capital employed in agriculture, for losses by disease, &c., are of such frequent occurrence, that the average result is reduced to but a small percentage on the capital ; however, there are pleasures met with in the pursuit of agriculture that go a long way towards compensating for the small profits it affords.

30. Suitable animals for fattening are difficult to procure in the districts around Madras, at anything like a price that will admit of a profit being made in fattening them for the market. In Mysore, Salem, and Nellore animals well suited for the purpose can readily be obtained ; but the rail charge for bringing them to Madras would in many instances add from 25 to 50 per cent. to their first cost, and the long drive from Nellore is attended with too many risks, to justify the feeder in himself making the venture. If there was a demand for suitable animals, I have no doubt but that dealers would soon appear, who would visit these districts, buy up the cattle, and drive them in large droves into the locality where the demand existed. Therefore, at present the person in this neighbourhood who would fatten stock for the market must, as a rule, content himself with old, worn-out draught bullocks or barren cows. A young healthy bullock weighing, say, 500 lbs., will sell readily as a draught bullock for Rupees 50, while for fattening it would not be worth more than Rupees 25, and even at that price the lean beef would be bought at the rate of 2½ annas per pound, rather a large price when it is remembered that for the beef when fat the feeder can only expect to get 4 annas per pound even when he himself acts as butcher and retails the beef ; a margin of only 1½ anna per pound with which to meet the cost of feeding the animal during four or five months, to stand against all the risks that attend the keeping of cattle in this country, and to pay expenses of retailing the meat. To show how the results of fattening vary with the kind of animal selected for fattening, I would direct attention to the following experiment. Two bullocks were selected ; they were very similar in general appearance. Both animals were similarly fed ; the daily food of each consisted of 3 pounds of horse-gram and as much fodder as it could consume, about 30 pounds ; the animals were weighed at the end of each week as the experiment progressed, with the following results :—

	Bullock No. 1. lbs.	Bullock No. 2. lbs.
1st Week	378	390
2nd do.	388	408
3rd do.	396	402
4th do.	416	390
5th do.	396	378
6th do.	406	395
7th do.	420	398
8th do.	413	395
9th do.	419	390
10th do.	427	399
11th do.	429	395
12th do.	456	396
13th do.	470	397
14th do.	473	...
15th do.	478	...
16th do.	503	...

It will be noticed that during the sixteen weeks' feeding, No. 1 made an increase in its live weight amounting to 125 lbs., equal to about 52 lbs. of beef, which, at annas 4 per pound, would represent Rupees 13.

The cost of producing this increase was—

	RS.	A.	P.
Gram, 3 lbs. per day, for 112 days, value at 36 lbs. per rupee ...	9	5	4
Fodder, 30 lbs. per day, for 112 days	8	6	4
Attendance, &c.	2	0	0
	19	11	8

The cost of producing this increase was, therefore, Rupees 6-11-8 in excess of its value, a result in harmony with what I have before experienced in similar experiments that I have made in feeding on gram. The special feeding of animal No. 2 was discontinued after the 13th week, as it was evident that it would not improve. These experiments are instructive, in showing how differently two animals will progress and lay on flesh, even when fed on exactly the same food and under exactly similar conditions. This fact is well known to feeders in England, who will frequently readily give from ten shillings to one pound per head more for cattle from one part of the country than for those from another part, though the cattle for which this high price is given may in no respect look better than those less appreciated. Unfortunately I know nothing of the previous history of these animals; but I should suppose that No. 1 came from one of the good grazing districts and had always enjoyed a sufficiency of food, while No. 2, I should imagine, was bred and reared in this district, and had passed through the various stages of fasting and over-feeding which characterise the management of cattle owned by our ryots.

31. During the past 12 months there has been but little demand for the services of the bulls kept at the Experimental Farm; however in the value of the work they have done in carting, ploughing &c., we have more than recovered the cost of their keep, &c. The bulls are all too large for the cows kept by the ryots who reside in the neighbourhood of the farm; the live weight of these cows varies from 200 to 400 lbs., while the lightest of the bulls at the farm will weigh over 800 pounds; the result is, that it is quite useless to put the bulls with at least 75 per cent. of the cows that are sent to them. It is a great mistake to expect to obtain a good cross between bulls of the large Nellore breed and the undersized, degenerated breeds of these districts. To improve the breeds of this district we must obtain a medium-sized bull of some breed known as suited for the dairy, perhaps a bull of the Aden breed would be the most suitable that can be procured.

32. *Sheep.*—The sheep-breeding experiment progresses steadily, and continues to yield

encouraging results. The last lambing season was again a satisfactory one; there were very few deaths, and the lambs generally were strong and healthy. The breeding sheep were managed in the same way as in the previous two seasons. Rams of both the Sydapet varieties were used; nearly the same number of ewes were given to the rams of each variety. As far as can be judged in the present state of the experiment, the sheep got by the rams of the brown variety are better flesh-producers than those got by the rams of the white variety; this is especially apparent in the lambs; thus, last season I selected 11 of the best lambs of each variety of about the same age (four months) and had them weighed; the results were as follows:—

	lbs.
11 lambs, 4 months old, white variety	350
11 lambs, 4 months old, brown variety	444

Thus, while the former gave an average of only 31·81 pounds per head, the latter averaged 40·36 pounds per head. However, as wool-producers, the sheep of the brown variety are much inferior to those of the white variety. I had not previously attached much importance to the wool-producing capabilities of the sheep of this variety, as the wool yielded by them sold at such a very low price (annas 1½ per pound) in the district; but recently I was enabled, through the kindness of Messrs. Walker and Co., of Madras, to submit a sample from some of the best fleeces for the professional valuation of a London wool broker, and was favored with the following gratifying report:—

"The two samples of wool sent to us for valuation are 'fair;' 'East Indian Yellows' worth here from 11*d.* to 11½*d.* per 'pound'". There is thus a wide margin between the local price, 2½*d.* per pound, and the London price, 11½*d.* per pound, with which to meet the cost of sending the wool to England. If we can succeed in raising the average quality of our wool to the quality of that submitted for valuation, it may after all become worth while to engage in wool raising even in this hot country. In comparison with the value of the wool produced in the colonies, this wool is certainly not a valuable kind, still the difference in value is not so great as might have been expected; thus, when this wool was valued, the following rates were quoted in the London Wool Market Report:—

	Ordinary per lb. s.	d.
Queensland and New South Wales	1	2
Victoria	1	3
Tasmania	1	3
New Zealand	1	2

The best colonial wool in unbroken fleeces was then selling at from two shillings and four pence to three shillings per pound. The rates quoted above are for wools classed as "broken pieces and locks," to which class the wool submitted for valuation belonged. If we can cross together the two varieties of the Sydapet breed, we may be able to produce an animal that will be valuable both for its wool and its flesh; it is, of course, exceedingly difficult, if not impossible, to produce a race of sheep that will excel both as mutton and as wool producers; but it is quite easy, by judicious crossing, to produce a variety that will yield fair returns of both. A few sheep of the Sydapet breed, which in size and form had not fully realised the expectations formed concerning them, were killed for mutton; the following were the results:—

—	No. 1.	No. 2.	No. 3.	Average.
	Pounds.	Pounds.	Pounds.	Pounds.
Legs	11	10½	10½	10·66
Loins	16	15	15	15·33
Shoulder, neck, and breast	20½	17½	14½	17·50
Total weight of mutton ...	47½	43	40	43·49
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Cash realised by the sale of mutton, skin, &c. ...	11 0 6	9 8 6	9 3 6	9 14 10

None of these sheep had been specially fattened; they had been fed along with the store sheep, and received no different treatment than they. They were in good average condition. Their mutton was well mixed with fat, and was tender. These weights are not great, indeed, they could have been greatly increased had this been desirable; neither were the joints unusually heavy; the mutton was worthy of notice rather for its fine grain, its fair proportion of fat and lean, its flavor, and the large proportion of flesh to bone, than for anything else.

33. *Pigs.*—The experiments made in 1871 in fattening pigs having given such very satisfactory results, the greater number of the pigs bred during the past year, not needed for stock purposes, were fattened for pork, instead of being sold as sucking pigs, as was the usual custom; in this way a much larger money return is secured, for instead of getting Rupees 3 for the pig at a month or six weeks old, we can, by fattening it, obtain from Rupees 18 to Rupees 25 for it when nine or ten months old. Most of these pigs were transferred to the Model Farm, where they were slaughtered and sold. The following statement, which refers to four well fattened pigs, shows the proportion of each kind of joint that each pig afforded, and the price obtained for each of these pigs :—.

——	No. 1.	No. 2.	No. 3.	No. 4.	Average.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
Legs	20	19	16	23	19·50
Loins	40	35	40	44	39·75
Shoulder	18	17	16	24	18·75
Neck and breast	12½	10	14	9	11·37
Total Weight of Pork ...	90½	81	86	100	89·37
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Cash realised by sale of Pork ...	25 2 0	23 9 0	23 1 6	29 10 0	25 5 6

It will be observed, on consulting the column headed "Average," that the coarser and inferior parts of these pigs (neck, breast, &c.,) weigh less than 8 per cent. of the entire weight of pork yielded by each pig; this is very satisfactory, as it proves that the pig stock at the farm has not degenerated, though it is now many years since the original stock were brought from Europe.

34. *Poultry.*—The Brahma Dorking cross, noticed so fully in my last report, continues to merit the high opinions formed of it. The cross has proved to be eminently suited for Southern India; specimens of the cross may now be met with in almost every part of the Presidency, and generally doing remarkably well. But the birds of this cross are not now confined to this Presidency, for their eggs have been sent to distant places beyond its limits, the advantages offered by the banghy post having been utilized to effect this.

35. The experiment in improving the breed of poultry in the Wudder Village has not been attended with as good results during the past year as could be wished. The people cannot, or will not, separate the half-grown fowls from those that are fully grown; the consequence is that the young hens begin to lay before they ought, which is most effective in putting a stop to any further growth. Early breeding is the great difficulty. The results of the experiment are, however, so far satisfactory that a 6-months' old half-bred fowl is as heavy as a 12-months' old country fowl. To ascertain what had been done towards improving the breed of fowls in the village, the people were asked a few months ago to exhibit their half-bred poultry at the farm yard on the Experimental Farm, a promise having been made to them that a number of small prizes would be distributed to the owners of the best birds. There were 30 entries for the competition; these consisted of cocks

20, hens 27, chickens 20; total 67. Several of the birds shown were really very good. The people said that they would have been able to have exhibited a very much larger number of half-bred poultry, had not great numbers been stolen from the village during the few weeks previous, and they added that it was only by the exercise of great watchfulness on their part that they were able to keep any of their fowls of the improved breed, thieves were so frequently on the look out for them. They requested that they might be provided with a further supply of cocks of the European breed. As long as the people attach so much importance to early laying, we cannot effect any lasting improvement in the breed of poultry kept by them. At the time the poultry were being exhibited in competition for prizes, I was sorry to notice how anxious the people were to direct attention to what they considered valuable in the half-bred fowls, namely, their early laying propensities: one man seemed much disappointed because he did not get a prize for a fowl he exhibited, which he declared was only three months old, and yet had laid several eggs; the hen was probably a little older than the age mentioned by its owner, still it was but a chicken, and was permanently spoiled by laying so early in life. The eggs exhibited of the half-bred fowls were not so good as I had expected to see; indeed, they were but very little larger than the ordinary country eggs; however the birds which laid them were all very young, and the size of the eggs will doubtless increase as the birds get older. In size and in quality the half-bred fowls were a very decided improvement on the fowls of the country breed previously kept in the village.

MANURE.

36. *Phospho-Guano.*—A small supply of this valuable manure was purchased in Madras for use in our field experiments. This manure has been long and favorably known in England and in Germany. Its high fertilising qualities have again and again been noticed by Liebig, Voelcker, and others. The manure contains, in round numbers, about 39 per cent. of soluble phosphate of lime, about 6 per cent. of insoluble Guano phosphates, nearly 4 per cent. of ready-formed ammonia as non-volatile ammonia, salts, and some potash. It was used on several experimental plots, but unfortunately, owing to the heavy rains immediately after the manure was applied, and the long drought which followed directly after, the manure did not meet with fair treatment; the results, therefore, were not recorded. It was, however, ascertained that the manure is very efficacious as an application for preventing sugar-cane cuttings from being attacked by white-ants, and it must be remembered, it at the same time affords the food needed by the sugar-cane during its growth.

37. *Bassia-nut Cake.*—In paragraph 93 of my last report I alluded to the manural effects of an oil cake known in the Madras bazaar as "Ilpa" cake, and expressed regret that I was unable to ascertain the botanical name of the tree, that yielded the nut from which the cake was made. Since the publication of that report, I have been favored with several communications regarding this tree; from one of these communications I make the following extract:—"The tree mentioned is the *Bassia longifolia;* it grows plentifully here (Mayaveram); it emits a disagreeable smell in the beginning of the rains, a smell that somewhat resembles that met with on entering a very filthy stable. The Tamil name of the tree is "Illuppu;" its Canarese name "Ippa" or "Ippi." The tree here is nearly as large as a mango tree, which it resembles very much in general appearance..... The stem of the Bassia is more knotty, and its leaves shorter than those of the mango." I have not met with an analysis of the oil cake made from the nut of the *Bassia longifolia* but in the current Number of the Journal of the Royal Agricultural Society of England there appears an analysis of the oil cake made from the nut of the *Bassia latifolia* by Dr. Voelcker, which analysis may be accepted as indicating pretty closely the general character of Bassia-nut cake; the analysis is as follows:—

		Per Cent.
	Moisture	13·54
(*a*)	Organic matter	80·79
	Phosphate...	1·43
	Magnesia, &c.	3·63
	Sand...	·61
		100·00
(*a*)	Containing nitrogen	2·73
	Equal to ammonia	3·31

38. *Alluvial Earth.*—A very large quantity of alluvial earth was raised in cutting the water channel to which I have previously referred. After full exposure for six months, this earth, which is raised in blocks, crumbles down to a fine powder, in which condition it makes an excellent surface-dressing for our poor sandy soils. Not only does such a dressing improve greatly the physical state of these soils, but it considerably increases their fertility, by supplying the food needed by crops. In addition to the ordinary constituents of alluvial soils, it was ascertained that this soil contains a very large percentage of sulphate of lime, chiefly as crystals of hydrated sulphate of lime, which greatly adds to its manural value. This alluvial deposit appears to underlie a considerable area of the Experimental Farm, as it has been recently met with in several places distant from each other where excavations have been made. It is met with at from 8 to 10 feet from the surface in a seam which varies from 5 to 10 feet in thickness. It is apparently a very old deposit, but it contains neither shells nor the remains of plants by which its probable age might be determined. Wherever it has been applied as a surface-dressing to sandy soils, there is a very marked improvement in the crops they afterwards produce.

39. *Caster-oil Cake.*—The very satisfactory results obtained in 1871 in the experiments made with oil cake as a manure, induced me to use it largely for a similar purpose last year On the two farms at Sydapet upwards of 50,000 pounds of oil cake was used in this way. The greater part of this was castor-oil cake, which for some time has been selling at a very moderate price, viz., Rupees 3½ per candy (500 lbs.), or about 15½ rupees per ton, delivered in Madras. The cake was generally used as a top-dressing after being first pulverized, applied at the rate of 200 pounds per acre. It was used on both dry crops and irrigated crops. On the latter the result was in most instances very satisfactory; but on the dry crops little effect was noticed; however, little else was to be expected; for in most instances no rain fell after the cake was applied; it consequently remained inert on the dry land, though still available as plant food when favorable conditions arise. I was induced to use castor-oil cake, because it could be procured at such a low price. I was not aware at the time I bought it that, as a manure, it is so much superior to most of the ordinary manural oil-cakes; but that this is the case is proved by an analysis recently made by Dr. Voelcker, F.R.S., and published in his paper on "Pure and Mixed Oil Cake" in the last Journal of the Royal Agricultural Society of England. He found the composition of castor-oil cake to be—

		Per Cent.
	Moisture	9·95
(*a*)	Organic matter	81·07
	Phosphate of lime and magnesia...	4·49
(*b*)	Alkaline salts	1·80
	Sand	2·69
		100·00
(*a*)	Containing nitrogen	8·69
	Equal to ammonia	10·55
(*b*)	Containing phosphoric acid	·06
	Equal to tribasic phosphate of lime	·13

It will be noticed that the cake is especially rich in nitrogen; it is, therefore, a powerful fertilizer. Its action is slow; but, when mixed with cattle manure, it becomes a great deal

more active and more fitted to meet the wants of quick-growing crops. For coffee and tea plantations a more useful auxiliary manure can scarcely be obtained, and it can in most parts of the Presidency be bought at a very moderate price.

40. *Poudrette.*—A large quantity of poudrette was made; it consisted of village ashes and the excrementitious matters collected daily from the village latrines. No special care was needed in the preparation of the manure; it was only necessary to guard against any of the decomposing matters being left uncovered. No smell was experienced after the ashes had been carefully thrown over all offensive matters. After remaining in heaps thus formed for 6 or 8 months, the manure became thoroughly deodorised and fit for use. In this state the coolies made no objection whatever to work with it; indeed, when thus deodorised, the character of the manure is so thoroughly changed, few persons could, from its appearance alone, determine the nature of its original ingredients. This poudrette was used with great success on maize, cotton, cholum, &c.; indeed, it is fitted for the wants of any of our cultivated crops.

CROPS.

41. *New Orleans Cotton.*—In my last report in paragraphs 70, 71, and 72, I noticed in detail, the results which had then been obtained from an experiment made with New Orleans cotton and maize, sown in alternate lines on a plot measuring 6,400 square yards. As the experiment with the cotton extended over two years, I was unable then to do more than notice the first year's results. I am now able to give the results of the whole experiment; but, to enable these to be understood, I must briefly notice again the facts mentioned in my last report. The cotton and maize were sown in September 1871. The land was prepared in the following way: first well ploughed, then harrowed, rolled, and weeded, &c.; afterwards ridged at distances about 24 inches apart, and in the furrows between these ridges, farmyard manure was applied at the rate of 20 cart-loads or 8 tons per acre; the ridges were then split through the centre by the plough, one-half of the raised earth being cast over the manure in the furrows on either side, thus raising new ridges with the manure under them; the newly-formed ridges were then harrowed by the chain-harrow to consolidate the soil; the maize and cotton were then sown alternately along the tops of the ridges, after which the chain-harrows followed along the line of the ridges and finished the work. When the crops were about 4 inches high, the various top-dressings were broadcasted over the surface of each plot, a showery morning having been selected on which to do this; the band-hoes and bullock-hoes when engaged in weeding worked the dressings into the soil. The following is an estimate of the cost per acre:—

	RS.	A.	P.
First Year.			
Ploughing, pulverizing, and cleaning the land	3	0	0
Ridging	0	8	0
Eight tons of manure	12	0	0
Carting and spreading manure	2	0	0
Splitting ridges	0	8	0
Chain-harrowing	0	2	0
Seed and sowing	1	0	0
Chain-harrowing	0	2	0
After Cultivation.			
Hand-hoeing and bullock-hoeing	10	0	0
Top-dressing and cost of application	18	8	0
Harvesting maize, including reaping, removal to yard, shelling, winnowing, &c.	4	10	0
Gathering cotton, ginning, &c.	10	0	0
Second Year.			
Ploughing between the rows of plants, hand-hoeing, bullock-hoeing, &c.	10	0	0
Gathering cotton, ginning, &c.	10	0	0
Total ...	82	6	0

RETURN PER ACRE.

First Year.

	RS.	A.	P.
661 lbs. of seed cotton = 189 lbs. clean cotton, at 120 rupees per candy	45	5	9
472 lbs. of cotton seed	4	0	0
1,793 lbs. of cobs = 750 lbs. of maize, at 45 lbs. per rupee	16	0	0
1,043 lbs. of cob stalks, skins, &c.	3	8	0
3,889 lbs. of straw	15	0	0

Second Year.

339 lbs. of seed cotton = 87 lbs. of clean cotton, at 120 rupees per candy	20	14	1
252 lbs. of cotton seed	2	0	0
Total ...	106	11	10

The commercial result of the experiment is a return amounting to Rupees 24-5-10 per acre in excess of the cost of production, which, with Rupees 5 per acre, the probable value of the manure yet unutilised in the soil, makes a gross return of Rupees 29-5-10 with which to pay rent, interest on capital employed, cost of supervision, &c. It is evident that a much better return would have been secured had I treated the cotton as an annual, and contented myself with the first crop instead of treating it as a biennial. The second crop only just repaid the cost incurred for weeding, gathering, &c., during the second year. From the results of this and other experiments that I have made, I would advise that, as a general rule, on light soils New Orleans cotton should not be treated otherwise than as an annual; still it may sometimes be advisable to leave the plants down a second year, for instance, in this district, when the north-east monsoon is so unusually early as to interfere with the late gatherings of cotton, or interfere with the preparation of land for the cold weather crops on the principle that "a bird in the hand is worth two in the bush."

42. The effect of the different top-dressings over the two years is worthy of special notice :—

No. of Plot.	Top-dressing applied.	Average yield per Plot.			
		First Year.			Second Year.
		Cotton in Seed.	Maize.		Cotton in Seed.
			Cobs.	Straw.	
		lbs.	lbs.	lbs.	lbs.
7—15	Not top-dressed	50·5	94	206	22·5
1— 9	Guano, 20 lbs.	52·5	179	415	31·2
2—10	Saltpetre, 30 „	55·5	147·5	365	29
3—11	Bone dust, 50 „	52·3	161·5	345	26·6
4—12	Animal charcoal, 50 „	56·1	126	244	25
5—13	Sulphate of lime, 228 „	52·5	122	270	27·8
6—14	Ilpa oil-cake, 200 „	60·	177	315	26·8
8—16	Carbonate of lime, 228 „	53·6	124·5	299	29·1
	Total yield of the 16 plots	866·0	2,263·0	4,918	436·0
	Total yield of 14 top-dressed plots ...	765·0	2,075·0	4,506	391·4
	Yield per acre of top-dressed land ...	661·1	1,793·3	3,889	338·8
	Yield per acre of undressed land ...	611·5	1,134·9	2,492	272·2
	Increase per acre due to top-dressings ...	49·6	558·4	1,397	66·6

43. The following table shows the average produce per acre of the different experimental plots with the quantity of manure used per acre in producing the results :—

Manure and Top-dressing per Acre.	Yield per Acre.			
	First Year.			Second Year.
	Cotton in Seed.	Maize.		Cotton in Seed.
		Cobs.	Straw.	
	lbs.	lbs.	lbs.	lbs.
8 tons of farmyard manure only	611·5	1134·9	2,492	272·2
8 do. do. and 242 lbs. guano	635·2	2165·9	5,021	377·5
8 do. do. and 363 „ saltpetre ...	671·5	1,784	4,384	350·1
8 do. do. and 605 „ bone dust ...	632·8	1954·6	4,180	321·8
8 do. do. and 605 „ animal charccal...	678·8	1524·6	2,968	302·5
8 do. do. and 2,758 „ sulphate of lime...	635·5	1476·6	3,280	336·3
8 do. do. and 2,420 „ ilpa oil-cake ...	726	2141·9	3,820	324·2
8 do. do. and 2,758 „ carbonate of lime.	648·5	1506·4	3,628	352·1

44. *Egyptian Cotton.*—A plot, measuring about one acre, was sown with Egyptian cotton and maize in alternate lines. The cotton grew admirably ; indeed, it seems quite as well suited to our soils and climate as any variety that we have yet grown ; it has, however, one serious defect—its spreading habit of growth—instead of growing upright like other varieties of cotton, it spreads over the ground ; and, while a plant frequently covers with its branches a space measuring from four to six square yards, there are few plants whose branches are three feet in height ; the result is that it is exceedingly difficult to clean land that is under this crop—cattle, in working hoes and cultivators between the rows of plants, commit such havoc amongst the lateral branches ; and we cannot afford the amount of manual labor required to keep the land clean if bullock labor is not employed. The Egyptian cotton-plant produces large bolls, and its fibre is both longer and more soft and silky, than that of the New Orleans variety.

45. *Yca Valley Cotton.*—The small plantation of this variety of cotton has been unfortunate during the past year, having been two or three times attacked by a borer, which, beginning at the tips of the branches, works down the pith into the hard wood, destroying all as it proceeds. The only effective plan of checking the depredations of this insect, was to cut off the affected branches a few inches below the portion injured, and to collect and burn them ; still the good result of this was only temporary, for, a month or two after each of these prunings, the plants were again in as bad a condition as before ; but, by persisting in cutting away injured parts of the plant, I hope eventually to get rid of the pest, though many fine plants will, in the meantime, be sacrificed in spite of every care. The insect appeared in the Yca valley plants in all the plots, though these were at a considerable distance from each other : no other variety of cotton was attacked by it, though in one or two instances the plots of Yca valley plants were quite surrounded by cotton plants of other varieties.

46. *Coimbatore Cotton.*—A piece of land, measuring about half an acre, was sown with Coimbatore cotton, and was manured and treated in the same way as the ordinary crops of New Orleans cotton. The result was very unsatisfactory ; gigantic plants, heavily covered by leaves, were produced, but the yield of cotton was exceedingly small ; the result is, however, quite in harmony with my previous experience, not only with native cotton, but with all indigenous crops ; an application of manure which would prove highly beneficial to any crop of a kind that is generally well cultivated, will produce disastrous consequences on a low-type indigenous crop that for generations has been used to a semi-starvation diet. If indigenous crops are ever to be subjected to high cultivation, this must be arrived at in slow and gradual stages.

47. *Sugar-cane.*—A small plot, measuring about 2,000 square yards, was planted with sugar-cane in February 1872. The experiment was instituted merely to ascertain whether

sugar-cane could be grown profitably on the ordinary soils of the Experimental Farm. The crop was manured with blood manure only, the preparation made on the Farm, which consists of slaughter-house refuse and village ashes. The following are the results of the experiment :—

Estimated Cost of Production.

	RS.	A.	P.
500 canes	15	0	0
16 cart-loads of manure...	16	0	0
Ploughing, &c., ...	1	8	0
Digging trenches	5	0	0
Manuring, &c., ...	2	0	0
Planting	2	0	0
Hoeing, &c.	8	0	0
114 waterings, at Annas 8 each...	57	0	0
	106	8	0

The crop was planted during the first week in February, and was harvested at about the same period in the following year. The cane was planted in lines about 3½ feet apart; there were 35 lines; of these, 24 were sold to bazaarmen for Rupees 69-8-9, and the remaining 11 lines which were the best, and were valued at Rupees 4 per line, were kept for farm use to provide cuttings for planting another crop. The total return was thus, say, Rupees 113-8-9 against an expenditure amounting to Rupees 106-8-0. However, in the case of a ryot who, instead of hiring all the necessary labour, works his land himself with the aid of an occasional laborer, the *actual* expenditure would have been very small, and the return obtained from the crop would have been ample to compensate him. If, instead of allowing the cane to mature, I had cut it down for fodder, a larger return would have been secured. An average row of canes was cut down in November; the canes weighed 1,162 pounds and the toppings 392 pounds, or together 1,554 pounds, which multiplied by 35, the number of rows of cane on the plot, gives a total weight of fodder amounting to 54,390 pounds, which at, say, 300 pounds per rupee, a very low price for such excellent fodder, would be worth Rupees 181-4-10, instead of Rupees 113-8-9, the price realised by the cane; while, if the crop had been cut for fodder at the time the single row of canes was harvested, there would have been a large saving in the cost of watering and weeding, and a large second crop would have been obtained. There can be no doubt but that sugar-cane as a fodder-producer is unequalled by any crop. Our Municipalities, with their abundant supplies of manure, might find it worthwhile to grow sugar cane as a fodder crop. They might produce it in all favorable localities at Rupees 5 per ton, at which price it should meet with a large demand for feeding milch cows and draught cattle.

48. *Elephant Grass.*—About a couple of years ago a tall, upright grass was noticed growing on the Experimental Farm amongst some paddy that had been raised from purchased seed. The grass had evidently been introduced from some distant part of the Presidency, as it was quite unknown to the people of the district around Sydapet. In habit of growth and in general appearance it resembles Shamay (Panicum Miliare), but its seed is much smaller than Shamay, and more like Cumboo seed. People from Bellary recognise the grass as the "Elephant Grass" of that district. An "Elephant Grass" is mentioned in Drury's Useful Plants of India, but it is apparently quite another grass. As the grass appeared to be a large producer, while the fodder seemed to possess some merits, I had a lot of the seed collected, and had it carefully sown on a plot of land measuring 624 square yards. The following are the results :—

Area of Plot.	No. of times ploughed.	Quantity of Manure used.	Date sown.	Quantity of Seed sown.	Date when germinated.	No. of times weeded.	No. of Waterings.	Date of 1st Cutting.	Weight of 1st Cutting.	Average Height.	Date of 2nd Cutting.	Weight of 2nd Cutting.
624 square yards.	Ploughed in puddle three times.	About 16 cart-loads of foldyard manure.	14th of March 1873.	9 lbs. of seed broadcast.	20th of March 1873.	Four times.	25	5th June 1873.	1,576 lbs.	3 feet.	25th of September 1873.	1,182 lbs.

49. *Yellow Cholum.*—As it is so exceedingly difficult to obtain a sample of yellow cholum seed free from rust, an experiment was made in order to test whether, when the seed has been dressed with sulphate of copper, the crop produced by it would be protected from rust, as is the case in England with crops raised from similarly dressed seed. The cholum seed was dressed in the following manner:—for each 50 pounds of seed 4 pounds of sulphate of copper was taken and was dissolved in 1 quart of hot water; this solution, when quite cold, was carefully poured over the seed, with which it was thoroughly mixed, and, when quite dry, the seed was sown in the ordinary way. The result was not what was anticipated; there was quite as much rust amongst the crops raised from the seed that had been dressed, as amongst those produced from undressed seed. The experiment needs to be repeated; I cannot believe that a process which in Europe is uniformly attended with good results, can be altogether useless here.

50. *Fodder Crops.*—A large quantity of fodder was produced; this was chiefly cholum and horse-gram. The greater part was consumed by the live stock on the Farm, the flock of sheep having been entirely fed at home, instead of being sent to graze in Guindy Park as was usually the custom. Not only was the Farm able to grow enough fodder to support its own large stock, but it sold during the year 80,000 lbs. of fodder to the Commissariat Department for feeding camels, elephants, &c., for which use gram fodder was generally preferred.

Implements, Machines, Tools, &c.

Ploughs.

51. During the past four or five years I have conducted a large number of experiments with ploughs of various kinds, some made entirely of iron, others made of wood and iron, and some made entirely of wood; and the result of these experiments, combined with the experience I have had in the working of the Sydapet Farms, convinces me that the best plough for general use is one constructed entirely of iron. It is true that an iron plough must always cost more than a plough that is made partly of iron and partly of wood, or than one made of wood; but in its extra durability, and in its greater efficiency, the iron plough possesses advantages which are cheaply purchased at the difference between the price that must be paid for it, and the price at which a plough made of other materials can be bought. The combined plough we make up in our workshops is certainly a good and useful implement, and one of these will cost only a little more than half the sum that an iron plough would cost; but, if I was engaged in farming on my own account, I should certainly much prefer to pay Rupees 33 for an iron plough, than to pay Rupees 18 only for a combined plough. I have recommended these combined ploughs, and would still recommend them; they are good ploughs, and perform their work much more efficiently than any ordinary plough now used by the ryot, while they do the work at a less cost; and, as they are more like the country plough in shape, the ryot takes to them more readily than he does to the iron plough. They are useful also in introducing the iron plough; where a combined

plough has been in use for some time; the introduction of the iron plough[1] is easy, the cattle will have become trained, and the cultivator will have learned to appreciate the advantage of getting his soil well turned over and thoroughly cultivated. These combined ploughs are employed on the Farms at Sydapet, where they are found useful for ploughing free arable land, or for turning over fallow ground that has previously been ploughed; they are also used for ploughing the spaces between the rows of cotton plants, &c.; for preparing land for paddy, especially in small beds, they have been found very useful, as they can be turned much more quickly and on a less space of ground than any of the ordinary iron ploughs. On most farms of a moderate size there is work specially suited to both an iron plough and to a combined plough; but where, from the small area of the holding, only one plough can be kept, which must be worked by the cultivator himself, an iron plough should be selected if the means can be commanded with which to purchase it. In the districts there would be no more difficulty in making up an iron plough than in making up one of the ordinary combined ploughs when once there is a demand for them sufficient to induce village smiths to learn the details of manufacture. I have experienced no difficulty in obtaining smiths who readily learn how to make an iron plough, and I do not think that any difficulty would be experienced by others if they will only hold out an inducement in the shape of a little extra pay.

52. The question for the consideration of the ryot when about to buy a plough is not so much the price that must be paid for it, *as the cost of the work that the implement will perform:* thus, if he can with an iron plough, making every allowance for labor, keep of cattle, for wear and tear, interest, &c., turn over his soil at the rate of 60 cubic yards for an anna, while with his country plough the cost of doing the same work would not be less than two annas, it is evident that the extra cost of the iron plough will be recovered in a very little time on a farm of moderate size; indeed, the ryot who cultivates a holding with but 20 acres of arable land can, by substituting an iron plough for his native plough, save, in a single season, a sum equal to its first cost, and it will, with ordinary care, last many years.

53. While I am thus convinced that the cost of the work done by an implement is the test by which the implement should be judged, I have not lost sight of the fact that in this Presidency there are a vast number of cultivators who have not the means with which to provide themselves with a good plough, even at the low cost at which the combined ploughs can be made. I have, therefore, during the past year, devoted some attention to the improvement of the ordinary native plough, chiefly with the view of lessening its draught, as though the weight of this so-called plough is less than that of any plough with which I am acquainted; its draught is exceedingly heavy from the very defective plan on which it is constructed. The following are some of the experiments that were made:—

1. An ordinary native plough, the dead weight of which was only 32 pounds, needed a force equal to 390 pounds to drag it through the soil when working.
2. An ordinary native plough, with some slight improvements, the chief of which was the removal of the upright flat surface behind the share by cutting down both sides. The dead weight of the plough was 36½ pounds, and the force needed to drag it when working was 336 pounds.
3. An ordinary native plough, improved as in No. 2 experiment, and fitted with a wooden mould-board. The dead weight of this plough was 57 pounds, but for dragging it when working a force equal to 280 pounds only was required.

In these experiments all the three ploughs were doing the same amount of work, from two cubic yards of earth, moved in each 100 yards of furrow, and they were all dragged in an uniform way by coolies. It will be observed that the improvements made, materially lessened the draught; it is also worthy of notice that the heaviest plough did its work with

an expenditure of nearly 30 per cent. less force, than the plough which was only about half its weight.

54. The American ploughs recently obtained from Boston, were used with great effect in the early part of last dry season, before the ground had become so hard as it usually becomes as the hot season advances. When the land is in this condition, it is almost useless to attempt to plough at all with any ordinary English plough; but these American ploughs did their work in a very satisfactory way in spite of the hardness of the soil. They are very clumsy-looking implements, and they are certainly transported over the farm with difficulty, but their working parts are admirably adapted for contending with rough work. If their working parts could be fitted to an ordinary English plough, a very useful implement would be produced; at present I see nothing to prevent this being done; at any rate I will have the experiment tried, as it is a serious drawback to our farming operations not being able to plough in the dry season. I certainly do not expect that we will ever get an implement that will turn over in the middle of the dry season, soil that has not been disturbed for some months previously; all I expect is to get an implement that will perform fair work, when the soil is a little too hard to be worked by any ordinary plough, for when the land is regularly hard, in the state in which when undisturbed it usually is, during the dry season in this part of India, it would be impossible to turn it over even with a steam plough. One or two experiments were made with the American ploughs. The following are the results of one of these experiments:—

—	Dead Weight.	Draught.	Work done.		
			Depth of Furrow.	Width of Furrow.	Earth turned over in 100 yards of Furrow.
	Pounds.	Pounds.	Inches.	Inches.	C. yards.
Complete	90	336	6	11	5·09
Without a wheel ..	80	392	6	11	5·09

For comparison with these results, I give below the results obtained with other ploughs tested at the same time, on the same ground, and under exactly similar circumstances:—

—	Dead Weight.	Draught.	Work done.		
			Depth of Furrow.	Width of Furrow.	Earth turned over in 100 yards of Furrow.
Description of Plough.	Pounds.	Pounds.	Inches.	Inches.	C. yards.
Ransomes and Sims' pony plough, complete ..	92	280	5	9	3·47
Ransomes and Sims', without a wheel ..	85	448	7½	9½	5·49
A Madras-made iron plough, with wheel ..	89	280	5½	9	3·81
Do. do. without a wheel.	80	364	6	9	4·16
A combined plough	67	290	5½	8	3·39
Howard's iron pony plough	86	336	7	8	4·32

55. *The Double Mhote.*—This is one of the best water-lifts that we possess. It was introduced on the Experimental Farm some time ago, and its capabilities were noticed at the time in a memorandum I prepared on "Water-lifts;" but now that I have had a more lengthened experience, I find that I have considerably under-estimated the amount of work that the machine is capable of performing, and have consequently over-estimated the cost at which the work is done. The following may be accepted as a fair estimate of the capabilities of the machine as now ascertained:—

Cost per day.

	RS.	A.	P.
Hire for one bullock and driver for one day	0	8	0
Interest and wear and tear at 10 per cent. per annum on the capital invested, say, Rupees 100, charged over 300 working days	0	0	6
Cost of replacing buckets and ropes three times a year, say, Rupees 90, charged over 300 working days	0	4	9
Oil, &c.	0	1	0
	0	14	3

The cost per day is therefore Annas 14 Pies 3. When working at the ordinary speed 90 buckets are raised per hour; each bucket contains 30 gallons when brought to the delivery spout; the height to which the water is raised varies from 20 to 24 feet; thus, 2,700 gallons of water are brought to the surface and discharged in one hour, or 24,300 gallons during an ordinary working day of nine hours, rather more over an acre of land, than a rain-fall of one inch. Taking 22 feet as the average height of the lift, it would appear that the machine raises about 27,000 gallons to this height for 1 rupee. This result is a great improvement on that obtained when the machine was first introduced. As in some districts the machine may not be known, or, if known, not recognised by the name under which I have noticed it, the following observations regarding its working and construction may be of use :—The water is raised by two leather buckets, similar to those in ordinary use in most parts of this Presidency; to each of these buckets is attached a rope which is fastened to a drum; one of these is coiled and the other uncoiled, as one bucket ascends and the other descends; the drum is fixed on a rotating spindle, to which is fixed at right angles the draught bar to which the bullock is attached; the diameter and thickness of the drum varies with the depth of the well; as a general rule, for all ordinary lifts the diameter of the drum may be equal to about one-fifth the number of feet that the water must be raised; the drum is placed about six feet above the ground in order to allow the rope to pass over the head of the draught bullock; the spindle upon which the drum is placed is kept in its upright position by means of two beams, into which it is fixed, which cross each other at the middle, and are supported at the ends on posts placed opposite each other on the outer side of the bullock path. The bullock walks under the draught bar attached to a curved yoke, which turns on a swivel. In raising water the bullock travels round the upright spindle, thus turning the drum and winding one rope and unwinding the other. If the diameter of the drum is as suggested, 1½ circuits around the path will raise each bucket to the requisite height; the bullock is turned round, facing the opposite direction, while each bucket is being discharged; no longer time is required to do this than is needed for the bucket to discharge its contents. This water-lift displaced one of the sort very common in this Presidency, sometimes known as the Single Mhote, that in which, when at work the cattle must walk down an inclined plane as each bucket comes to the surface, and be backed up again to the mouth of the well as the bucket again descends. This machine, with a pair of cattle, raised only 12,600 gallons of water in a day, while the cattle were exceedingly hardworked in doing this; backing up an incline with a slope of about 45 degrees, about forty times per hour, is a most effective way of rendering cattle worthless. The cost of working this lift was as follows :—

Cost per day.

	RS.	A.	P.
Hire for a pair of bullocks and driver for one day	1	0	0
Interest and wear and tear at 10 per cent. per annum on the capital invested, say, Rupees 100, charged over 300 working days	0	0	6

	RS.	A.	P.
Cost of replacing bucket and rope four times a year, say, Rupees 60, charged over 300 working days	0	3	2
Oil, &c.	0	0	4
	1	4	0

The cost, therefore, of raising 12,600 gallons by this lift was Rupees 1-4-0, or only 10,080 gallons for 1 rupee against 27,000 gallons for 1 rupee, the cost of doing similar work by the improved machine.

56. *Seed-drills.*—The English seed-drills made by Messrs. Garret & Co., of Suffolk, which were transferred to the Sydapet Farms about a couple of years ago, and which at one time I feared would be very unlikely to meet with useful employment, have proved of great use to us since our land has been levelled and brought under proper culture ; indeed, nearly the whole of last season's crops were sown by them, and the work was done efficiently, quickly, and at a very moderate cost, allowing for the quality of the work. In sowing cholum, cumboo, or any similar crop in lines from 9 to 15 inches apart, the machine will, in a field of an ordinary size, sow about 6 acres per day at the following cost :—

	RS.	A.	P.
One pair of cattle with driver, one day	0	12	0
One man guiding the machine, one day	0	3	0
One man attending the machine, one day	0	3	0
Oil, &c.	0	1	0
	1	3	0

Or about Annas 3-2 per acre, a very low price for work of the quality done by the machine. In the estimate I have excluded interest and wear and tear, but if we assume that during a single year the machine, on a farm of sufficient size to employ it, would sow, say, 300 acres, a debit of Annas 2 per acre will be enough to meet the charge for interest and on the capital invested in the machine, &c. It would thus appear that the cost of drilling with seed an acre of land by one of these machines, is about Annas 5-2, or about eight pence in English money.

The Model Farm.

57. The past year was an unfortunate one for the Model Farm. The cyclone in the beginning of the year and the floods in November, caused a great amount of damage ; several hundred plantain trees just beginning to bear were blown down and rendered useless, and the mango and cashewnut fruit crops were entirely destroyed ; and the effects of the floods in November were even more serious. The early rains in August and September had induced me to put down the paddy crop earlier than usual, and when the extraordinary floods came in November, about 20 acres of healthy crop, about one-third grown, were submerged and killed, and the portion of the plantain tope which had escaped the ill-effects of the cyclone was also destroyed. The loss from these two causes was great. Before the cyclone an offer of Rupees 400 for the plantain tope had been refused, and after the floods it was with difficulty that 20 rupees could be realized for it. The 20 acres of paddy destroyed would represent a loss of Rupees 400 at the least. Indeed, at a fair estimate, including the value of the fruit lost, the destruction of the plantain tope, and the loss of the 20 acres of paddy, &c., the total loss was certainly not under 1,000 rupees.

58. A considerable quantity of indigo was grown, and the results were generally satisfactory. Besides feeding its own live stock, the farm sold nearly 100,000 lbs. of green fodder. Fair crops of paddy were produced on the land that was re-sown after the floods, but when sold

the market rates were low, 112 Madras measures per 3½ rupees. The following result was obtained from a rather superior portion of this crop :—

Area of Plot.	Weight of Straw.	Measures of Paddy	
		When thrashed.	When dry.
Square yards. 468	lbs. 733	Measures. 76	Measures. 68

Return per Acre.

	Rs.	A.	P.
7,583 lbs. of straw, at Rupees 6 per ton	20	5	0
703 measures of dry paddy, at 112 measures for Rupees 3½ ...	21	15	6
	42	4	6

59. The expenditure during the year was as follows :—

	Rs.	A.	P.
Rent, rent charge, and interest	913	1	6
Labor, including Overseer's pay	1,969	14	0
Cattle	361	0	0
Pigs	103	8	0
Sheep	132	0	0
Poultry, rabbits, &c.	39	11	0
Implements, &c....	277	8	6
Seeds	153	9	2
Cattle food	506	3	11
Manure	185	2	7
Sundries	16	6	9
	4,658	1	5

60. The income was as follows :—

	Rs.	A.	P.
Advance from General Funds	1,772	2	2
Cattle	371	15	0
Sheep	237	2	6
Pigs	664	5	9
Poultry, rabbits, &c.	203	4	0
Fruits	409	0	0
Plantain and vegetables	35	1	6
Hay, grass, and straw	484	13	6
Grains	178	11	2
Sundries	301	9	10
	4,658	1	5

61. The following is the balance sheet on the 31st of March 1873 :—

Liabilities.

	Rs.	A.	P.
Loan from General Funds, 1870-71	2,776	9	10
Do. do. 1871-72	1,310	3	11
Do. do. 1872-73	1,772	2	2
Overseer's and laborers' pay due for March 1873 ...	157	6	8
	6,016	6	7

Assets.

Cattle.

18 Working cattle	1,350 0 0		
13 Fattening cattle	260 0 0		
		1,610	0 0

Sheep.

17 Ewes. 7 Wethers. 7 Gimmers.	186 0 0		
10 Lambs	15 0 0		
		201	0 0

Pigs.

4 Boars and geldings. 2 Sows.	120 0 0		
10 Young pigs	80 0 0		
		200	0 0

Poultry.

7 Brahma Dorking fowls and chickens 13 Country fowls. 3 Geese and goslings. 37 Ducks and ducklings.	50 0 0		
Pigeons and rabbits	12 0 0		
		62	0 0

Implements.

Carts, tools, &c., as catalogued		732	12 6

Manures.

10,709 lbs. of manure cake	64 4 1		
100 Cartloads of fold-yard manure	75 0 0		
16 Cartloads of sulphate of lime and ashes ...	10 0 0		
¼ Cost of purchased manure bought in 1871-72.	17 8 0		
¼ Cost of cake purchased and consumed in 1871-72	100 0 0		
½ Cost of manure purchased in 1872-73 ...	60 7 3		
½ Cost of cake purchased and consumed in 1872-73	253 1 11		
Straw	70 0 0		
		650	5 3

Young Fruit Trees.

1,250 plantain trees	200 0 0		
Cocoanut and grafted mango trees	125 0 0		
		325	0 0

Growing Crops.

Guava. Mango and tamarind. Cashewnut, &c. Hay field. Indigo. Cotton. Brinjals.	660 0 0		
6 Acres of Carolina and kar paddy	150 0 0		

Guinea grass	100 0 0			
Fodder	350 0 0			
		1,260	0	0

Seeds, &c., in Granary.

2,682 lbs. of chumba paddy	45 0 0			
55½ lbs. green gram	2 0 0			
25¼ lbs. cotton in seed	1 8 0			
44½ lbs. wool	5 0 0			
		53	8	0
Sundries	... ...	175	0	0
Uncollected bills	... ...	310	8	8
Cultivation done for the next season's crop	... ...	75	0	0
One-third of the value of thatch used in roofing cattle and pig styes, &c.	... ...	18	14	5
* Deficiency	... ...	342	5	9
	Total...	6,016	6	7

Establishment.

62. The general conduct of the overseers, clerks, and apprentices was satisfactory during the year under review.

IMPLEMENT WORKSHOPS.

63. Besides doing a large amount of repairs for the two Farms at Sydapet, and doing most of the carpentry work for the new cottages, these workshops supplied during the year two improved tilting-bodied carts, a dozen ploughs, two iron cultivators, one chaff-cutter, one maize sheller, 76 improved reaping knives, one seed drill, a number of plough shares, wheel-barrows, field tools, &c., and several working models of ploughs, &c. The following are the details of income and expenditure during the past year :—

Expenditure.

	RS.	A.	P.
Plant	63	2	6
Labor	1,433	10	3
Materials, &c.	1,183	9	10
Interest on capital	65	0	0
Contingencies	23	10	0
	2,769	0	7

Income.

Advance from General Funds	1,077	3	2
Labor, materials, &c.	870	2	1
Machines, implements and tools	821	11	4
	2,769	0	7

IMPLEMENT WORKSHOPS' Balance Sheet for the year ending 31st of March 1873.

Liabilities.

Advance from General Fund for 1870-71	883	1	5
Do. do. 1871-72	213	1	2
Do. do. 1872-73	1,077	3	2
Laborers' pay due for March 1873	115	15	1
	2,289	4	10

* Since the Farm was commenced.

Assets.

Buildings	419	15	3
Plant	310	0	6
Materials	175	2	0
New implements, machines, &c., in stock	576	12	0
Outstanding bills	589	14	0
Deficiency	217	9	1
	2,289	4	10

There was, therefore, at the close of the year a debit, amounting to Rupees 217-9-0, against the workshops, that is, after paying every charge, interest on capital from their commencement, which sum will be debited in next year's account. I pointed out in paragraph 130 of my last report the great advantages that the Sydapet Farms gained from the conveniences afforded by these workshops, advantages of much greater value than the nominal deficit on the working of the institution during the 27 months it has been in operation.

(Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms

APPENDICES.

Rainfall registered at the Experimental Farm during the year ending 31st March 1873.

April 1872.	May 1872.	June 1872.	July 1872.	August 1872.	September 1872.	October 1872.	November 1872.	December 1872.	January 1873.	February 1873.	March 1873.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1 ... 3·90	1	1	1	1 ... ·45	1	1	1	1	1	1 ... ...
2	2 ... 3·40	2	2	2 ... ·68	2	2	2	2	2	2	2 ... ...
3	3 ... ·25	3	3	3	3	3 ... ·64	3	3	3	3 ... 1·20	3 ... ...
4	4	4	4	4	4	4	4	4	4	4 ... 4·25	4 ... ...
5	5	5	5	5 ... ·37	5	5	5 ... 1·90	5	5	5 ... ·65	5 ... ...
6	6	6	6	6	6 ... ·12	6	6	6 ... 2·64	6	6 ... ·13	6 ... ...
7	7	7	7	7 ... 1·82	7	7 ... ·20	7 ... ·11	7 ... ·94	7	7	7 ... ...
8	8	8	8	8 ... 1·45	8	8	8	8	8	8	8 ... ...
9	9	9	9 ... ·15	9 ... ·22	9	9	9 ... ·40	9	9	9	9 ... ...
10	10	10	10	10	10	10	10	10	10	10	10 ... ...
11	11	11	11	11	11	11 ... ·67	11	11	11	11	11 ... ...
12	12	12	12 ... ·43	12 ... ·14	12	12 }	12	12 ... 1·56	12	12	12 ... ...
13	13	13 ... 1·25	13	13	13 ... 1·86	13 } 13·60	13	13	13	13	13 ... ...
14	14	14	14	14	14 ... ·67	14 }	14 ... ·69	14	14	14	14 ... ...
15	15	15	15 ... ·15	15 ... ·16	15	15	15	15	15	15	15 ... ...
16	16	16	16	16	16 ... 1·26	16 ... 1·20	16 ... 1·75	16	16	16	16 ... ...
17	17	17	17 ... ·14	17	17	17	17	17	17	17	17 ... ...
18	18	18 ... ·16	18	18	18	18	18 ... 1·88	18 ... 1·70	18	18	18 ... ...
19	19	19	19	19 ... ·82	19	19 ... ·75	19 ... 1·86	19 ... ·88	19	19	19 ... ...
20	20	20	20	20	20	20	20 ... ·63	20	20	20	20 ... ...
21	21	21	21	21	21 ... ·45	21 ... 1·10	21 ... ·22	21	21	21	21 ... ...
22	22	22	22	22	22	22	22 ... 1·00	22	22	22	22 ... ...
23	23	23	23	23	23	23 ... ·10	23 ... 4·70	23	23	23	23 ... ...
24	24	24	24	24	24	24	24 ... 5·40	24	24	24	24 ... ...
25	25	25	25	25	25	25	25 ... ·53	25	25	25	25 ... ...
26	26	26	26	26	26	26	26	26	26	26	26 ... ...
27	27	27	27	27	27	27	27 ... 2·78	27	27	27	27 ... ...
28	28	28	28	28	28	28	28 }	28	28	28	28 ... ...
29	29	29	29	29	29	29	29 } 7·28	29	29		29 ... ...
30	30	30	30 ... 1·68	30 ... ·80	30 ... ·15	30	30	30	30		30 ... ...
	31		31 ... ·40	31		31		31	31		31 ... ...
Total...None.	Total...7·55	Total...1·41	Total...2·95	Total...6·46	Total...4·96	Total...18·26	Total...31·13	Total...7·22	Total...None.	Total...6·23	Total.None.

Government Farms' Expenditure

	Rs.	A.	P.	Rs.	A.	P.
I. *General Supervision.*						
Establishment ...	9,486	15	8			
Stationery and contingencies ...	289	11	5			
Travelling expenses ...	1,530	3	4			
				11,306	14	5
II. *Sydapet Experimental Farm.*						
Establishment ...	911	2	2			
Cooly labor ...	3,031	9	8			
Implements and machines ...	394	5	2			
Live stock ...	338	1	0			
Seeds ...	306	8	6			
Food for live stock ...	1,281	3	8			
Manures... ...	382	11	8			
Despatching seeds ...	221	10	3			
Contingencies ...	346	14	9			
				7,214	2	10
III. *Estate Improvements of Permanent Character* ...				4,333	12	0
IV. *Sydapet Model Farm.*						
Establishment ...	600	0	0			
Cooly labor ...	1,369	14	0			
Manure ...	185	2	7			
Live stock ...	636	3	0			
Food for live stock ...	506	3	11			
Seeds ...	153	9	2			
Implements ...	277	8	6			
Rent and interest ...	913	1	6			
Contingencies ...	16	6	9			
				4,658	1	5
V. *Implement Workshops.*						
Carpenters, smiths, and filer ...	1,209	8	8			
Cooly labor ...	224	1	7			
Implements, machines, and materials...	1,246	12	4			
Rent and interest ...	65	0	0			
Contingencies ...	23	10	0			
				2,769	0	7
VI. *Special (Educational).*						
Apprentices and Schoolmaster ...	1,807	2	2			
Apprentices' quarters ...	3,019	11	9			
Books for agricultural library...	80	6	0			
Contingencies ...	56	0	2			
				4,963	4	1
			Total ...	35,245	3	4

Government Farms' Receipts.

	Rs.	A.	P.	Rs.	A.	P.
I. *Sydapet Experimental Farm.*						
Rents (including fruit rents) ...	1,375	9	5			
Cattle ...	256	3	10			
Sheep ...	213	10	3			
Pigs ...	147	0	0			
Poultry, rabbits, &c. ...	79	4	6			
Feeding grains, seeds, and cattle food ...	639	10	9			
Machines, &c. ...	442	10	0			
Hay, fodder, sugar-cane, and cotton ...	1,122	8	2			
Sundries ...	94	5	9			
				4,370	14	8

	Rs.	A.	P.	Rs.	A.	P.
II. *Sydapet Model Farm.*						
Cattle ...	371	15	0			
Sheep ...	237	2	6			
Pigs ...	664	5	9			
Poultry, rabbits, &c. ...	203	4	0			
Fruits, plantains, and vegetables	444	1	6			
Hay, green fodder, &c. ...	484	13	6			
Grains ...	178	11	2			
Sundries ...	301	9	10			
				2,885	15	3
III. *Implement Workshops.*						
Machines, &c. ...	821	11	4			
Materials and labor ...	870	2	1			
				1,691	13	5
Total ...				8,948	11	4

Valuation of Live and Dead Stock on the Experimental Farm on the 31st of March 1873.

	Rs.	A.	P.	Rs.	A.	P.
Cattle—						
3 Bulls	1,600	0	0			
23 Working cattle						
5 Feeding cattle						
Sheep—						
20 Rams	800	0	0			
65 Ewes						
21 Gimmers						
55 Lambs						
Pigs—						
2 Boars	400	0	0			
14 Sows						
23 Young pigs						
Poultry	55	0	0			
				2,855	0	0
Manures.						
Guano, bones, charcoal	...	...	...	350	0	0
Fold-yard and other manures						
Growing Crops.						
Fodder (of sorts)	500	0	0			
Plantains, &c.	250	0	0			
Guinea grass	200	0	0			
Cotton	150	0	0			
				1,100	0	0
Farm Seeds.						
900 lbs. of horse gram	23	0	0			
221½ „ of indigo seed	8	0	0			
222½ „ of castor-oil seed	7	0	0			
50 „ gingelly	3	0	0			
194 „ corkapilly seed	10	0	0			
1,072 „ of shamay	43	0	0			
864 „ of cotton seed	22	0	0			
245 „ sumba paddy	6	0	0			
333 „ Carolina paddy	11	0	0			
626 „ yellow cholum	16	0	0			
				149	0	0
Cattle Food.						
203 lbs. ground-nut cake	...	...	...	2	0	0
Implements.						
Implements and tools as catalogued in Inventory	...	...	...	6,000	0	0
Total ...				10,456	0	0

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st of April 1873.

1 Portable steam engine, 8-horse power, by Ransomes and Sims.
1 Set of steam ploughing and cultivating apparatus, tackle, windlass, porters, &c., by Fowler and Co.
Chaff-cutter and universal mill, with bullock-power, by Ransomes and Sims.
1 Threshing machine with a bullock-power, by Emery Brothers.
1 Threshing machine, by Dray Taylor and Co.
1 Threshing machine, with bullock gear and carriage, by Ransomes and Sims.
1 Threshing machine with bullock gear and carriage, by Garret and Co.
2 Winnowing machines, by Garret and Co.
1 Winnowing machine, by Ransomes and Sims.
1 Winnowing machine, by R. T. Smith.
1 Winnowing machine, by Hornsby and Sons.
3 Reaping machines by Samuelson and Co.
1 Drill sowing machine, 8 rows, by Garret and Co.
1 Cylindrical corn screw, by Ransomes and Co.
2 Ploughs, by Ames and Co., Boston.
1 Turn-wrest plough and yoke, by Ransomes and Co.
1 Stone roller.
2 Drill sowing machines, 13 rows, by Garret and Co.
1 Wood drag-harrow, by Experimental Farm.
2 Iron chain harrows.
1 Combined grubber.
3 Bullock hoes.
2 Bullock ploughs, by Howard and Co.
1 Bullock plough, by School of Arts.
2 Bullock ploughs, by Mint.
2 Bullock ploughs, by Ransomes and Sims.
1 Double mould-board plough.
1 Large plough, with 2 wheels, by Ransomes and Sims.
1 Swing-plough, by Roorkee Workshop.
1 Mould-board country plough, by Experimental Farm.
1 Wood swing-plough, by Ransomes and Sims.
1 Wet-land plough, by Experimental Farm.
1 Country drill, by Experimental Farm.
1 Wooden roller.
1 4-wheel waggon.
1 Stone trolley.
1 Root-pulper, by Ransomes and Sims.
3 Country carts.
1 Water cart.
1 Sewage cart, by Gun Carriage Works.
1 Maize-sheller, by Ainsworth and Co.
1 Corn drill.
1 Barrow drill, by Experimental Farm.
1 Rain gauge.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
1 English ladder.
1 Norton's tube-well with a rotary motion.
1 English grind stone.
1 Farm bell.
2 Wheel hand-hoes.
8 Cattle yokes.
2 Single bullock carts.
1 Overhead, bullock-power, with shafts and gearing.
1 Sugar-cane mill.
1 Californian pump.
1 Archimedian pump.
1 Cake-crusher.
1 2-wheel plough with cultivator, by Ransomes and Sims.
1 Pump, by Roorkee Workshop.
1 Chaff-cutter, manual-power.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon and Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
5 English carts.
1 Malabar spoon bale.
2 Waterproof cart-covers.
1 Sack-barrow.
1 Portable scale with weights.
6 Piccottah buckets.
2 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
15 Wheel-barrows.
3 Hay frames for carts.
1 Farm clock.
3 Tables.
5 Chairs.

1 Writing desk.
2 Almyrahs.
1 Iron cash-chest.
1 Dynamometer.
1 Surveying level with stand-staves, &c.
1 Set of bottle levels.
Chemical apparatus, mortars and pestles, glass-beakers, &c.
26 Feeding tubs.
5 Metal feeding troughs.
1 Scythe.
1 Manure drag.
2 Bengal picks.
2 Dutch hoes.
2 Bengal hoes.
8 Hand hoes.
6 Forks of sorts.
8 Iron rakes.
25 Mamooties.
3 Hatchets.
3 Jumpers.
17 Crowbars.
17 Picks.
3 Mattocks.
2 Hedge shears.
2 Billhooks.
1 Iron reel.
8 Grass knives.
3 Manure forks.
15 Digging forks.
6 Shovels.
4 Sets of bullock harness.
2 Surveying chains with pins.
1 Iron cistern.
A quantity of wire, rope, and a large number of details belonging to steam plough.
35 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Ear punch for marking sheep.
1 Branding iron for marking sheep.
1 Marcal, one half-marcal, and one measure.
2 Weeding spuds.
3 Pairs of sheep shears.
7 Planters' hoes.
1 Fork hoe.
1 Pruning knife.
1 Dibble.
1 Pick hoe.
1 Billhook.
1 Lactometer.
1 Levelling board.
1 Single barrel fowling piece.
1 Pair of pan scales.
1 Theodolite.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1*st of April* 1873.

2 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
2 Country carts.
1 Box cart.
6 Reaping hooks.
6 Hand hoes.
8 Picottah buckets.
1 Chopper.
21 Feeding tubs.
1 Levelling board.
2 Spades.
3 Small wheel-barrows.
1 Clock.
6 Digging forks.
7 Yokes.
8 Planters' hoes.
1 Tub for well.
1 Scythe.
1 Weeding spud.
1 Tarpaulin.
1 Measure.
1 Half-marcal.
1 Scale triangle, weights, &c.
1 Large beam and cattle-weighing scale.
9 Fifty-six pound weights.
4 Plough shares.
1 Table.
2 Hand hoes.
1 Knife.
1 Hay fork.
1 Mamoty.
1 Pair pincers.
1 Hammer.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Bell.
1 Water-cask.

List of Tools, &c., in the Implement Workshop on the 1*st of April* 1873.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
18 Tongs.

2 Bellows.
2 Screw plates.
4 Sledge hammers.
6 Small hammers.
6 Chisels, "Smith's."
6 Punches.
1 Counter-sinking punch.
4 Dies or flat chisels.
1 Pair calipers.
1 Iron square.
6 Round files.
2 Half-round files.
3 Flat files.
1 Small square file.
3 Large files.
2 Three-cornered files for saw.
16 Taps for screw plates.
1 Iron brace and 5 bits.
1 Filer's hammer.
1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
1 Bench with 2 vices.
3 Hand saws.
1 Pit saw.
1 Cross-cut saw.
7 Augurs.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
9 Carpenters' chisels.
1 Cold chisel.
2 Set squares.
1 Angle square.
6 Gimlets.
1 Brace, with 36 bits.
2 Adzes.
1 Hammer.
1 Turn screw.
1 Plummet.
5 Saw files.
4 Rasps for wood.
2 English pattern bellows.
2 Bits for planes.

List of Books added to the Apprentices' Library during the year 1872-73.

Letters on Modern Agriculture by Von Liebig.
Morton's Veterinary Pharmacy, 1868.
Horses—The Gentleman's guide for choice, treatment, and management of saddle, carriage, gig and cart horses, by James Mills, M.V.C.S.
Cotton Hand-book for Bengal, 1862, by J. G. Medlicott, B.A.
The Neilgherry Tea Planter, 1870, by James McPherson.
New American Farm Book originally by R. L. Allen, 1871, revised and enlarged by Lewis F. Allen.
How Crops Grow, 1869, by S. W. Johnson, M.A.
Elements of Agricultural Chemistry and Geology, 1871, by J. F. W. Johnston, M.A., F.R.S.S.L., &c., E.
An Elementary Hand-book of Physics, 1871, by William Rossiter, F.R.A.S., &c.
The South of India Observer Almanac and Neilgherry Guide and Directory, 1872.
The Reason Why, Physical Geography and Geology, 1863.
The Gardener's and Farmer's Reason Why, 1860.
The Asylum Press Almanac, 1873, by William Thomas.
The Coffee Planter's Manual, 1872, by Alex. Brown, Kandy.
S. Holman's Illustrated Catalogue of Machinery and Tools.
The Elements of Mechanism, containing a familiar explanation of the construction of various kinds of machinery, &c., 1859, by Thomas Tate.
Farm Implements and Machinery, Vol. I., 1869.
Cotton Culture, 1868, by Joseph B. Lyman.
The Journal of the Royal Agricultural Society of England, part I., vol. VIII., 1872.
The Commissariat Code, 1872, by Major H. P. Hawkes.
A Treatise on Sheep, 1853, by Ambrose Blacklock.
An Elementary Introduction to Mineralogy, 1837, by William Phillips, F.L.S., &c.
The Indian Economist, 1872.

The Country Gentleman's Magazine, Vol. III.
A Book of Catalogues and Pamphlets.
The Indian Economist, Agricultural Gazette of India, and the Statistical Reporter, 1870.
Manual of the Bellary District, 1872, by John Kelsall.
Zoology, Vol. II., 1848, by William B. Carpenter, M.D., F.R.S., &c.
Popular Mineralogy, 1850, by Henry Sowerby.
Rudiments of Zoology, 1855, by Chambers.
The Forest Trees of Britain, Vol. II., 1849, by Rev. C. A. Johns, B.A., F.L.S.
A Treatise on the External, Chemical, and Physical Characters of Minerals, 1817, by Robert Jameson.
Practical Mineralogy, 1843, by Edward J. Chapman.
On the use of Lime in Agriculture, 1849, by James F. W. Johnston, M.A., F.R.S.S., &c.
The Zoologist's Text-book, Vol. II., 1832, by Captain Thomas Brown.
Cassell's Outlines of Botany, 1860, by Dr. J. Scoffern, M.B.
Introductory Text-book of Geology, 1855, by David Page, F.G.S.
Chemistry in its applications to Agriculture and Physiology, 1853, by Justus Liebig, M.D., &c.
Contributions to Scientific Agriculture, 1849, by James F. W. Johnston, M.A., F.R.S.S., &c.
Zoology, Vol. I., 1848, by William B. Carpenter, M.D., F.R.S., &c.
Practical Mineralogy, Assaying and Mining, 1851, by Frederick Overman, Mining Engineer.
Commercial Hand-book of Chemical Analysis, 1850, by A. Normandy.
Elements of Agricultural Chemistry and Geology, 1852, by James F. W. Johnston, M.A., F.R.S.S., &c.
Advanced Text-Book of Geology, 1861, by David Page, F.G.S.
A Manual of Elementary Geology, 1851, by Sir Charles Lyell, M.A.
Useful Knowledge of British Husbandry, Vol. I., 1834.
Do. do. Vol. II., 1837.
The Farmer's Encyclopædia, by Cuthbert W. Johnson, Esq., F.R.S.
Cotton Hand-book for Bengal, 1862, by J. G. Medlicott, B.A.
The Farmer's Companion, by R. W. Dickson, M.D.
The Mechanic's Library or Book of Trades, by C. F. Partington.
Manual of Botany, 1849, by John Hutton Balfour, M.D., F.L.S., &c.
Chemistry of the Four Seasons, 1846, by Thomas Griffiths.
Catechism of Practical Agriculture, 1845, by Henry Stephens, F.R.S.E.
Instructions for the Analysis of Soils, Limestones, and Manures, 1845, by James F. W. Johnston, M.A.
Catechism of Agricultural Chemistry and Geology, 1844, by James F. W. Johnston, M.A., &c.
A Treatise on Botany, 1851, by Richard D. Hoblyn, A.M.
Hints to Amateur Gardeners of Southern India, 1860, by Andrew Thomas Jaffrey.
Indian Hand-Book of Gardening, 1840, by G. F. Frederic Speede.
Rudiments of Geology, 1845, by David Page.
Researches on the Chemistry of Food, 1847, by Justus Liebig, M.D.
Cattle, their Breeds, Management and Diseases, 1860, by W. C. L. Martin.
Rural Economy, 1860, by Martin Doyle.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST OF MARCH 1874.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT GAZETTE PRESS.

1875.

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APPENDIX.

1. Rainfall of the year.
2. Government Farm's Expenditure.
3. Valuation of Live and Dead Stock belonging to the Experimental Farm.
4. Implements, Carts, Machines, &c., belonging to the Experimental Farm.
5. Do. do. do. to the Model Farm.
6. Do. do. do. to the Implement Workshops.
7. Catalogue of Books added to the Library.

THE ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT FARMS, FOR THE YEAR ENDING 31ST OF MARCH 1874.

GENERAL.

1. *Weather.*—The total rainfall of the past year was 48·07 inches, or only about half the amount that fell in the previous year. Rain fell on sixty-nine days; the total amount collected approximated very closely to the average of the previous ten years, but its fall was unseasonable.

2. In April rain fell on three days, during which 2·38 inches were registered, giving an average of 0·79 inches for each wet day; there was no rain whatever in May, so that the little good that was done by the fall in the previous month was negatived. In June the quantity registered was 1·68 inches; but, as it fell on six days, the average for each wet day was only 0·28 of an inch, a fall too light to be of any benefit during the scorching heat that characterises that month. The fall in July was even lighter; though rain fell on nine days, the total quantity registered was only 1·50 inches, giving an average of 0·17 of an inch for each wet day. In August the fall was somewhat more favorable, though still below the average; in this month rain fell on seven days, and the total fall was 3·16 inches, or 0·45 of an inch for each wet day. Thus in the three months—June, July, and August—though rain fell on twenty-two days, the total fall only amounted to 6·34 inches. The average of the previous ten years for these three months was 12·56 inches precipitated on thirty-one days, so that during this quarter, which is the period of the year in which cumboo, gingelly, and other hot weather crops are grown, the rainfall was just about half the quantity that we usually get, and this is generally but just sufficient to meet the wants of the crops then cultivated. The result of this unfavorable season on the Sydapet Farms was that the hot-weather crops had to be resown several times, and the sowings, which were at length successful, being from a month to six weeks behind time, the harvest was proportionally delayed, and the consequence of this was that the land on which these crops grew, could not be cleaned and prepared in time for the regular cold-weather crops, which in their turn were delayed. In September, which is the harvest month for hot-weather crops, the rainfall was unusually heavy; though there were only seven days in this month on which there was rain, the total quantity collected was 7·24 inches, or a little more than one inch per wet day. In October rain fell on eighteen days, and the total fall was 12·30 inches; throughout this month rain fell in gentle showers, the average for each wet day was 0·68 of an inch. In November the fall was unusually light, being only about half the average fall; in this month rain fell on fourteen days, and the quantity registered was 8·91 inches; the whole of this fell in the latter half of the month, there was no rain whatever until the 12th. The rainfall in December was excessively heavy, being nearly twice as great as the average fall; though there were only five wet days, the fall was 10·90 inches, or 2·18 inches for each wet day. I would particularly invite attention to the rainfall registrations of this month; it will be at once observed how delusive monthly totals are. I have said that the rainfall of this month was nearly twice as great as the average, yet our crops actually suffered severely from drought in December, for after the 4th of the month there was only one day on which rain fell, and this only amounted to half an inch; this drought was especially severe in its effects, coming as it did so closely after heavy rain, which had caused an excessive rank growth in the crops and rendered them particularly liable to injury, when the drought suddenly checked this rapid growth. During January, February, and

March, there was no rain whatever, and many of the crops sown in November were rendered useless, excepting for providing fodder.

3. The following table shows the amount of rain that was registered during each month, and the number of days in each month on which rain fell, compared with the average monthly registrations of a similar kind for the preceding ten years :—

——	1873-74.		Average of the previous 10 years.	
	Inches.	Wet Days.	Inches.	Wet Days.
April	2·38	3	0·55	1·1
May	...	...	0·85	1·4
June	1·68	6	2·73	7·8
July	1·50	9	4·52	11·2
August	3·16	7	5·31	12·4
September	7·24	7	3·83	9·4
October...	12·30	18	8·67	10·9
November	8·91	14	13·66	14·0
December	10·90	5	5·64	6·3
January	...	...	1·08	1·4
February	...	...	0·91	0·9
March	...	...	0·08	0·4
Total ...	48·07	69	47·83	77·2

4. The following is a statement for the same period, made out in weekly totals, which I think exhibits the rainfall of the year in a much more satisfactory way than the method usually adopted :—

——	1873-74.		Average of the previous 10 years.		——	1873-74.		Average of the previous 10 years.	
	Inches.	WetDays.	Inches.	WetDays.		Inches.	WetDays.	Inches.	WetDays.
1st Week...	2·20	2	...	...	28th Week...	4·22	6	·38	1·1
2nd do. ...	·18	1	·01	·1	29th do. ...	1·55	4	4·81	4·0
3rd do. ...	...	...	·19	·3	30th do. ...	1·41	2	1·75	3·1
4th do. ...	...	...	·35	·7	31st do. ...	1·08	1	1·74	2·4
5th do. ...	...	...	·76	·4	32nd do. ...	...	...	2·27	3·1
6th do. ...	...	...	·01	·3	33rd do. ...	2·24	5	2·15	2·9
7th do. ...	...	...	·05	·3	34th do. ...	2·80	3	4·00	4·0
8th do. ...	...	...	·03	·3	35th do. ...	10·02	7	4·60	3·4
9th do. ...	...	...	·13	·3	36th do. ...	4·25	3	4·16	2·6
10th do. ...	·48	2	·64	1·0	37th do. ...	...	...	·62	1·3
11th do. ...	·66	2	1·19	2·5	38th do. ...	·50	1	·30	·6
12th do. ...	·17	1	·32	1·8	39th do. ...	...	...	·19	1·2
13th do. ...	·37	1	·45	2·3	40th do. ...	...	...	·03	·4
14th do. ..	·56	3	·25	1·6	41st do. ...	...	...	·01	·1
15th do. ...	·04	1	1·54	2·9	42nd do. ...	...	...	·57	·6
16th do. ...	·15	2	·99	3·0	43rd do. ...	...	...	·47	·2
17th do. ...	·75	3	1·07	2·6	44th do. ...	...	...	...	...
18th do. ...	·53	2	1·25	2·6	45th do. ...	...	...	·70	·6
19th do. ...	...	...	1·70	3·4	46th do. ...	...	...	·02	·1
20th do. ...	...	...	·54	3·0	47th do. ...	...	...	·12	1
21st do. ...	2·46	4	1·17	2·0	48th do. ...	...	...	·07	·1
22nd do. ...	1·12	2	1·27	2·7	49th do. ...	...	...	·08	·4
23rd do. ...	·23	1	·77	2·7	50th do. ...	...	...	...	...
24th do. ...	...	...	·92	2·3	51st do. ...	...	...	...	...
25th do. ...	2·50	3	1·40	2·4	52nd do. ...	...	...	...	...
26th do. ...	3·56	2	·64	1·5					
27th do. ...	4·04	5	1·15	1·9	Total ...	48·07	69	47·83	77·2

5. *Tours.*—No tours were undertaken by me during the past year, as I had found by experience that I could not, in a satisfactory way, when on tour, perform the many important duties which I am now called upon to undertake, unless aided by a really competent Assistant at my head-quarters; while my duties, as Secretary to the Exhibition, required my presence in Madras during the cold season.

6. *Office-work.*—My office-work still continues to increase; it was exceedingly heavy during the past year; to some extent this was caused by the Agricultural Exhibition in February last, to which I was Secretary; in connection with this I had to conduct a very large amount of correspondence, and as all the money-transactions relating to this undertaking were conducted in my office, a great amount of additional labor was thrown upon my establishment, and this, in connection with the fact that the office-work was already much behind, has placed me rather in a difficulty with regard to the performance of current work; but with the aid of the Assistants recently appointed, I hope, before the expiration of another year, to have worked off all arrears.

7. The large increase in my office-work is not, I think, any cause for regret, provided I am furnished with the means to enable me to keep pace with it; but it is a serious labor and a cause of much anxiety to me, the effort to carry on my current work with such an accumulation of arrears demanding more or less urgently my attention.

8. It is, I consider, greatly to be desired that, as far as possible, my office should be the medium through which agricultural information relating to the Presidency should be collected and disseminated; to some extent this is already recognised as its legitimate work, and I have done all I could to increase its usefulness in this direction by encouraging correspondence with persons, in all parts of the Presidency, interested in agriculture, who may be able and willing to afford information, or who may be anxious to benefit by our experience.

9. The following questions selected from those put in the demi-official letters received by me during the last year will convey a general idea regarding the subjects on which I am consulted. The questions included in this list are but a small number of those that have been answered during the year :—

District, Presidency, or Province from which the Questions came.	General Nature of Question.
Cochin	Requesting full instructions regarding the cultivation of guinea grass.
Madras	Asking for directions regarding the method of working European ploughs and cultivators.
Cochin	Asking for information about the culture of fodder crops.
Madras	Asking for information about the ground-nut oil cake, how used, quantity given daily to working cattle, &c.
Bellary	Asking advice regarding shrubs best suited for forming live fences in the Bellary District.
Ganjam	Asking for information regarding the culture of Carolina paddy and New Orleans cotton.
North Arcot...	Asking for advice regarding laying down land under pasture and the variety of grass best suited.
Wynaad	Asking for advice regarding fodder crops best suited for Wynaad and their general cultivation.
Rangoon	Asking for information about the cultivation of potatoes and the manure to be employed; also desiring to be informed the breed of sheep best suited for the higher lands in Burmah.
Madras	Asking for opinion regarding the probable success of a European butchery in Madras.
Madras	Asking for advice regarding the use of ground-nut cake in feeding horses.
Mysore	Asking for information and advice regarding turn wrest ploughs.
Punjab	Asking for advice regarding the use of ground-nut cake in feeding horses.

District, Presidency, or Province from which the Question came.	General Nature of Question.
Trichinopoly	Asking advice regarding the probable growth of grass and cocoanut trees under sewage irrigation.
Wynaad	Asking information regarding the most suitable manure for land under coffee.
Mysore	Asking for advice regarding the construction of cattle-sheds.
Madras	Asking for advice regarding the construction of a sheep-pen for fattening sheep.
Ganjam	Asking for detailed information regarding ploughs best suited for use in native agriculture.
North Arcot	Asking for advice regarding the construction of cattle-sheds.
Mysore	Asking how adulteration can be detected in a sample of ground-nut cake.
Bombay	Asking to be informed the steps to be taken to gain a knowledge of the practices of improved agriculture.
Madras	Asking information regarding the feeding qualities of ground-nut oil cake.
North-West Provinces ...	Asking for advice regarding the preparation of paddy hay and its value for horses.
Madras	Asking for opinion regarding the supposed tendency of ground-nut oil cake to excite unduly the urinary organs of animals fed on it.
Madras	Asking for instructions regarding the cultivation of Carolina paddy.
Tanjore	Opinion asked regarding purity of a sample of ground-nut oil cake and whether fit for use in feeding horses.
Travancore	Asking where a pupil could be trained in a knowledge of agricultural chemistry, and asking for suggestion that would assist a beginner in analytical work.
Godavery District	Asking for information as to the probable effects of nightsoil used as a manure for trees, and asking opinion regarding general value of nightsoil as an agricultural manure.
Malabar	Inquiring the commercial value of groundnut oil, and asking the uses to which it can be applied.
Ganjam	Asking to be informed how to select a sample of soil for analysis? how to drain the subsoil of land? and how to improve indigenous breeds of cattle?
Calcutta	Asking for full details of cultivation of the ground-nut, and description of climate and soil best adapted for its healthy growth.
Kistna District	Asking for advice regarding the study of agriculture, and the sciences bearing thereon.
Wynaad	Asking advice regarding the treatment of cattle suffering from rinderpest.
Trichinopoly	Requesting opinion of the feeding value of gingelly oil cake for milch cattle.
Madras	Asking advice regarding treatment of sick poultry.
Madras	Inquiring regarding the value of Indian corn as food for horses, and the preparation it should undergo before being given to them.
Coimbatore District ...	Asking to be advised regarding the selection of a plough for use by ryots.
Wynaad	Asking opinion regarding leaf disease on coffee trees, probable cause, treatment to be followed, &c.
Tinnevelly	Asking for advice regarding the utilization of waste lands by planting, &c.
Tanjore	Asking for advice regarding the establishment of a Model Farm to be managed by a private association composed of native gentlemen.
North-West Provinces ...	Asking for advice regarding the plough best suited for introduction amongst native cultivators.

10. *Agricultural Apprentices.*—In my last annual report, and in a special report, I directed attention to the very unsatisfactory conditions under which the District Farm Apprentices are placed for gaining a knowledge of agriculture; it is, therefore, unnecessary again to go over

the same ground here. The following "examination results" will convey a general idea of the kind of information with which these Apprentices are expected to become acquainted :—

	Full Marks.	A.	B.	C.	D.	E.
DISTRICT FARM APPRENTICES' EXAMINATION HELD ON THE 11TH OF JUNE 1873.						
Paper Examination.						
1.—The pay of a cooly is 5 Rs. a month of 30 days ; he is absent 8 days ; what pay is due to him ?	10	10	10	10	10	10
2.—A heap of manure measures 8 yards in length, 4 yards in width, and 7 feet in depth ; what are its cubical contents ?	10	10	5	10	10	...
3.—If a plough travels at the rate of 1½ miles per hour, turning over a furrow slice 9 inches wide, what area will it plough in a day of 8 hours, deducting 20 per cent. for turnings at the headlands ?	10	...	5	...	...	...
4.—On 485 square yards of land I broadcast 50 lbs. of castor oil-cake manure ; how many pounds will be required to manure an acre of land at the same rate ?	10	10	...	2	10	10
Vivâ Voce Examination.						
1.—How many coolies will hoe one acre of land in a day of 9 hours, the land being under cotton moderately free and not foul with weeds ?	5	5	1	1	2	2
2.—How many loads of earth from a heap should one man fill and cart to a distance of 1 mile in a day of 8 hours ?	5	2	5	...	4	3
3.—At what rate per hour do the farm-cattle travel when ploughing ?	5	4	2	2	5	...
4.—What medical treatment did the cattle suffering from foot-and-mouth disease undergo ? ...	5	4	5	2	4	...
5.—What has been done during the last few days in field 25 ?	5	5	5	4	5	4
6.—What was the cost of cutting the drains in No. 16 field ?	5	...	2	3	4	2
7.—About how many pounds per acre did the crop of gram fodder in No. 4 field yield ?	5	...	...	...	...	...
8.—How many pounds of cotton will a cooly collect in a day of 9 hours if at the time there is about 60 lbs. per acre on the trees ?	5	...	5	2	2	...
9.—About how many gallons of water does the lift in well No. 13 raise in a day of 8 hours ? ...	5	...	...	...	...	...
10.—What price per cubic yard would you give for excavating earth in No. 14 field (in the present condition of the soil) and conveying it to a distance of 10 yards ?	5	1	2	4	5	4
11.—How many pounds of seed cotton did the cotton gin clean during an ordinary working day ?	5	...	2	2	2	1
12.—What quantity and description of foods are given to the working cattle, feeding cattle, and sheep ?	5	2	2	4	4	2
Total ...	100	53	51	46	67	38

11. It will be noticed that the majority of the questions are framed to test whether the apprentices take an intelligent interest in the work of the farm, as the training, such as it is, to which they are subjected is exclusively field training. The result of this examination is fairly satisfactory ; it was quite impossible that the youths could have prepared themselves specially for it, as the examinations are not held at stated times, no previous notice was given of the intention to hold the examination, and the questions put were framed in the room while the examination was proceeding.

12. Though, making due allowance for the circumstances under which they were placed, these apprentices have done fairly satisfactory, they have made but very little progress towards qualifying themselves to hold District Farm Superintendentships ; however they are not to be blamed on this account, it was decidedly a mistake to suppose that Hindu youths, without any knowledge whatever of agriculture or of kindred subjects, would in the space of three years by mere field employment on the Sydapet Farms, become qualified to hold the Superintendentships of District Farms. Such a training, as I have often pointed out, should qualify them to manage small farms of their own, situated in localities similarly circumstanced to the Sydapet Farms, and it should qualify them for employment as Overseers under efficient superintendence ; but it could not, in reason, be expected to do more than this. Under a good system of theoretical and practical training in the lecture room and the field, there would be no difficulty whatever in training educated native youths thoroughly in agriculture.

13. It has been contended that, because in England and Scotland farm bailiffs undergo no special training, that it is therefore unnecessary in India to place under special training youths who intend only becoming farm overseers ; but persons who view the matter in this light forget the important difference in the early training, habits and circumstances of the men who, in Britain, become farm bailiffs, and of the men who in India would become farm overseers.

14. In Britain the embryo bailiff passes through something like the following stages of enployment before he is appointed a bailiff :—On leaving the village school, say at 12 or 13, the youth becomes a ploughboy, and is employed in general farm work until he is, say, 18, when he becomes a waggoner or ploughman ; a year or two later he perhaps is made the foreman ploughman ; his next step in promotion is his appointment as yardman, next his appointment to be foreman in charge of women and field workers ; and, finally, when perhaps nearly 30 years old, he is appointed bailiff. While passing through these various stages in training the man is employed at all kinds of agricultural work ; he meets with but little that is opposed to his early training or prejudices ; he hears good farming favorably spoken of on all sides, and he adopts naturally the improving agriculture he sees generally practiced.

15. How different are the circumstances under which a youth is placed in this country who wishes to become a farm overseer where rational agriculture is practiced. Probably, at 18 he leaves school, when perhaps he possesses a fair knowledge of the English language ; he goes, let me say, to Sydapet to undergo training, where he finds everything different to what he has been accustomed ; he finds implements and machinery in use the names of which he even does not know ; he sees crops growing of which he had no previous knowledge ; he sees manures applied which he never heard of before ; he sees field operations performed when soil and season suit, with a perfect disregard to the opinions of the astrologers of the locality, in respect to "lucky" and "unlucky" days, &c. ; he sees animals purposely fed for slaughter to provide human food, a practice which he at first, from his previous training, looks upon with horror ; in short, to him almost everything around is new, the operations conducted are novelties, and the part he is to take in what is going forward is equally strange.

16. Is it just, therefore, to expect that by undergoing say three years employment in field work on the Sydapet Farms that native youths should become as competent agriculturists as are farm bailiffs in Great Britain ? Hindus and Mahomedans are ready and willing to learn more rational systems of farm management, and will, I have no hesitation in saying, make good agriculturists, farm overseers, farm superintendents, &c., but it is essential to success that the

system of agricultural training under which they are placed should be especially suited to their circumstances.

17. *Improvements, &c., on the Sydapet Estate.*—During the past year the principal roads through the Experimental Farm were entirely re-made with gravel and laterite ; and the grass sidings, which were previously much higher than the roads and caused injury to them during the rains by preventing their proper drainage, were cut down to a level sufficiently low to allow of the surface of the roads being well drained. The work was costly, but the good effect will be experienced for years. About four acres of land rendered almost barren from the ill-effects of swamp cultivation was subsoil drained and restored to a healthy state. A large cart-shed was built at the Experimental Farm buildings, there not having been a cart-shed there previously. This shed consists of a tile roof on palmyra rafters and reepers supported by pillars formed of brick built in lime. A considerable amount of levelling was done in the fields on both the Sydapet Farms. All necessary repairs were done to buildings, bridges, &c., on the estate. A large number of cocoanut trees were planted out that had been raised on the farm from nuts, a number of these were planted around the buildings on the Experimental Farm to afford shade, most of them are growing luxuriantly.

18. *The Wudder Settlement on the Sydapet Estate.*—In the centre of the Sydapet Farm estate there is a plantation of tamarind trees which covers about six acres of land ; in this plantation there are one hundred and fifty leaf-huts occupied by a colony of Wudders, who are said to be the descendants of persons who were brought into the district to work on the estate. When counted on the 23rd of April 1872 these people numbered 201 men, 218 women, and 250 children ; total 669 persons. The ground on which these huts stand is now almost entirely surrounded by cultivated land.

19. The settlement is a very serious nuisance, not only because, from the situation of the huts, many people are brought through the farms during both night and day over whom it is impossible to exercise any control, unless we incur a serious expense in employing a large staff of watchmen, but chiefly because it is a nursery and hot-bed of disease. Health statistics were collected amongst these people from the 1st of August 1872 until the end of June 1873 ; during these eleven months there were twenty-four deaths, and possibly some deaths may have occurred when the people were temporarily residing away from their huts, and may not have been registered. Taking the registrations for the eleven months, the annual death-rate was 38·86 per thousand, a very high rate. During the same period there were 243 cases of illness amongst these Wudders, that is, separate attacks of sickness, each sufficient to prevent the sufferer from attending to his or her usual work ; the names of a few of the people occur more than once in the sick list, but most of the cases were distinct attacks on different individuals varying in duration from one day to 14 days ; making a full allowance for the persons who were sick more than once, it appears that one in every four persons in this settlement was attacked by illness. The sickness generally was dengue and small pox ; the former produced a greater number of cases, but not a greater amount of real sickness, than was experienced in former years when the people were attacked by small pox and intermittent fever of a severe type and by cholera.

20. The entire removal of this Wudder settlement to a healthier and more suitable locality is now, I believe, absolutely necessary. Something could be done to improve the sanitary state of the place where the people now reside, but the cost of effecting any substantial improvement would be great. Thus it would be necessary to take down many of the huts and re-construct them on other portions of the site, a number of trees should be cut down, and the brushwood should be entirely removed ; the waste-water channel, which forms the northern boundary of the site, should be deepened, the numerous cuttings and holes in the ground where the huts stand should be filled up in order to prevent the accumulation of filth, but to effect these improvements a considerable outlay would be necessary, while a large annual expenditure for scavenging &c., would be needed.

21. But such an expenditure would yield no good results if the Wudders belonging to this settlement, when engaged in contract work and residing at a distance from Sydapet, are to be allowed to send here those of their number who are attacked by disease during such absence. Living at these times under conditions so unfavorable to health, and exposed to attacks of contagious diseases by associating in large numbers with others of their class from other localities, they keep the settlement here well supplied with material for the dissemination of disease in this neighbourhood.

22. Instead of spending money in attempting to improve the place where these Wudders reside, it would be much less costly, and better in every way, to purchase a suitable piece of ground of sufficient area and present it to the people as a site for a village, and to pay them compensation for their trees growing on the farm land. In planning a village it would be easy to arrange for the proper distribution of the huts to admit of sanitary matters receiving due attention.

23. This settlement now puts the Experimental Farm to a considerable annual expense; thus during the year ending the 31st March last its outlay on this account was Rupees 281-1-3, while the income from the rents collected from the people amounted only to Rupees 113-10-0.

24. This colony of Wudders is of but little value in affording labor for the farms; as a general rule the people prefer to take contracts in connection with roads, railways, tanks, and other extensive undertakings rather than to work regular hours on a fixed daily pay; it is not, that they can earn throughout the year a larger average daily pay than they could earn on the Sydapet farms, but by excessive labor under contract rates they can make sufficient to enable them to indulge occasionally in the luxury of a few days of idleness; it is only when there is nothing attractive offering in contracts that we can secure their services, and this is generally only when from the state of the weather excavating and similar work is costly.

25. *Snakes and other vermin killed on the Sydapet Estate.*—During the past year the following snakes, squirrels, and rats were killed on the two Sydapet Farms:—

Cobras	54
Other snakes...	555
Squirrels	70
Rats...	170

The rewards paid are very trifling; thus we pay for a cobra 2 Annas, for any other snake 1 Anna, for a squirrel 1 Anna, and for a rat ¼ Anna; small as are these inducements they have had a very satisfactory effect; large snakes are now seldom met with on these farms, whereas about four or five years ago they were very abundant. No deaths from snake-bites have occurred amongst farm employés during the last six years, though several have been bitten; but during this time two or three persons unconnected with the Farms, have died from bites of snakes inflicted when on farm land.

26. I was warned when I first began to kill all snakes indiscriminately on the Sydapet Farms that the crops would suffer severely from attacks by rats which would increase greatly in numbers; rats are certainly very troublesome, but not more so than they were before we began to kill the snakes; indeed, as far as it is possible to judge, I think we have fewer now; we encourage the presence of the mungoose, of owls, and cats amongst our crops, and these keep down the rats.

27. The only way of keeping down dangerous snakes is to kill all the snakes met with; there is such a similarity in the general appearance of many poisonous and harmless snakes that it is quite impossible during the brief time that a snake is in a man's power that he can distinguish whether it is a poisonous or a harmless variety, and any attempt to do this generally results in the escape of the snake. Harmless snakes may serve a useful purpose where there is much prickly-pear and other dense low growth of a jungly character covering the ground, but in open cultivated country, owls, cats, and the mungoose are quite able to keep down the rats.

28 One very clear result of keeping down the snakes is a very large increase of birds on the estate ; these may to some extent prove injurious at harvest time, but the good they do at other seasons far more than counterbalances this. Our crops enjoy almost perfect security from attacks of insects, ants excepted. Our summer crops, which generally mature when there are no other grain crops growing in the neighbourhood, are severely attacked by birds, but these come from a distance in large flocks, and are chiefly parrots and wild pigeons. I believe that our field crops suffer far more from squirrels than from rats, and these destructive little creatures are much more difficult to capture ; they are especially destructive on crops just appearing above ground, in nipping off young shoots, maize is especially injured in this way. Snakes may to some extent keep down these pests also, but the same would be effected by cats, the mungoose, &c.

29. *Agricultural Exhibition.*—An agricultural exhibition was held on the Experimental Farm in February last ; it was the first of a series of similar exhibitions which it is proposed to hold in selected parts of the Presidency. Exhibits were sent to it from each district, also from Travancore and Cochin ; its entire management was entrusted to this Department. The land selected for the exhibition grounds was about ten acres in extent ; the sheds, which were built to accommodate not only the produce and machinery but also the whole of the live stock, were very extensive, there being in all nearly two acres of roofing ; though they were only for temporary use, it was necessary to make the sheds sufficiently substantial to guard against the effects of a sudden storm, while the roofing had to be sufficient to protect visitors from the heat of the sun. Owing to the short time at our disposal for making preparations and the enormous quantity of material required, it was only by the exercise of great exertions that we succeeded in getting ready the accommodation necessary by the date fixed for opening. The exhibition was, on the whole, a success, making due allowance for the difficulties that had to be overcome ; but, as I have already submitted a special report, it seems unnecessary to make any further references to the matter here.

30. *The absence of a local demand for superior agricultural productions.*—Much difficulty is experienced in meeting with purchasers for live stock and field produce of a superior kind, if a price is demanded that bears any fair relation to the cost that has been incurred. Until there is a very general improvement in the agricultural practice of this country, this difficulty is likely to continue. Favorable commercial results can never be secured by farmers who raise superior stock and produce (necessarily at a heavy expenditure of time and money) unless they meet with a ready demand at fair prices for such superior productions.

31. The English breeders of stock, who have become famous in all parts of the civilized world from the splendid results they have achieved, would have remained unknown and their skill would have been unappreciated had there not been men equally as intelligent and enterprising ready to buy at reasonable prices whatever their skill produced. The high state of excellence to which certain races of cattle and sheep have been raised, is to be attributed almost entirely to the fact that there existed a ready demand for such excellence, a demand which fully recognized the cost of producing such superiority.

32. Not only is there as yet no demand at fair prices for superior breeding stock or field seeds amongst the so-called farmers of this country, but there is no wholesale demand for properly fattened stock or other superior agricultural productions ; the raisers of such having no choice but themselves to retail the produce to consumers, and here, setting aside all considerations bearing on the unpleasant necessity of the farmer having to become a retail dairyman, grain-seller, or butcher, a serious difficulty presents itself, *viz.*, the difficulty of keeping up, from any single farm, a continuous supply of such produce sufficient to meet a regular retail demand ; in this country field produce comes in with great irregularity, which must continue to be the case as long as our operations in the field are so materially affected by the weather.

33. There is undoubtedly a market for superior productions suitable for export, provided they can be raised in sufficient quantities. Small parcels receive little or no attention from merchants

unless the prices ruling for ordinary productions of the kind are accepted ; thus the enterprising cultivator, who grows a few acres of Carolina paddy, maize, or New Orleans cotton, finds, when ready for market, that these superior productions will bring him in no more money than those he ordinarily raises, because the local demand cares not for superiority, and, because the quantities are too small for export; this latter difficulty will, of course, disappear as these productions become more generally grown, when also will be generated a demand for seeds for raising these superior crops. It is now exceedingly disheartening to the cultivator who has been sufficiently enterprising to grow one or more of these improved crops to find, as has often been experienced, that the money returns obtained are but very little greater than resulted from the cultivation of the indigenous crops they displaced.

34. While such are a few of the difficulties experienced on first introducing new crops, the difficulties attending attempts to improve agricultural live stock in this country are equally great. I have again and again met with persons who, with creditable enterprise, have purchased good stock, and have gone to much expense and trouble in breeding and rearing the produce of this stock in the hope that at any rate the actual expenditure would have been recovered, who have had to complain that even this modest expectation has not been realized; this was not from any want of judgment in selecting the stock or deficiency of skill in their management, but simply because there was no demand even at moderate prices. The fact is natives generally who, of course, are the only extensive stock-owners in this country, cannot yet be made to comprehend that a well-bred bull which has been properly reared may be much cheaper at 150 Rupees than an ordinary bull reared under their usual management is at 60 Rupees. Early maturity, propensities that will give a large return in milk or in meat for the food consumed, good constitution, shape, size, &c., count for little in their estimation. I do not here allude to animals of breeds that have been introduced, which may not be altogether suited to the present condition of our agriculture, but to superior animals of indigenous breeds.

35. Disheartening as these facts appear to be, they are not less encouraging than might have been expected, seeing how ignorant and prejudiced our cultivators are. In every country reforms are difficult to carry out where they seek to improve customs that have long been in operation, and the improvements that we would effect in the farming of this country go to the very root of customs which have been adopted for generations. Mere self-interest will never effect reforms amongst a people who are uneducated and so superstitious as our ryots ; it is not to be supposed that they are less avaricious than other people, but they have not the intelligence to see what is their own interest.

36. *Fish-preservation.*—The river Adyar forms the boundary of the Sydapet Farm estate no the southern and eastern sides ; the portion thus owned by the estate is about two miles in length with a width of about 25 yards, that is, half its average width, as the claim extends only to the centre of the river. The Adyar drains and flows through a very poor country ; the greater part of its water is the overflow and wastage of several large tanks situated some miles to the west of Sydapet ; its flow is perennial, though very slight in the hot season. During September, October, November, and December a large quantity of water passes down, and occasionally the river is very much flooded. Where it begins to form the boundary of the Experimental Farm it swells out to a considerable width, and again contracts after passing the farm buildings, thus forming a basin of considerable area, in this its depth varies from four to twenty feet ; as it flows eastwards its width gradually lessens until at one place it is not more than fifteen yards wide ; here an anicut has been placed, which has had the effect of raising the height of the water on its upper side at the least four feet ; below this anicut the river again gradually widens to about fifty yards, which is about its average breadth for the next mile ; below this, and to the sea, a mile or two further down, it widens considerably. Excepting the anicut just noticed, the channel of the river is quite free from the sea, up to where the river ceases to form the boundary of the farm estate ; but at times when the flow is slight, the sand thrown up by the surf waves, where it enters the sea, accumulates to such an

extent as to block up its channel until a flood in the river again opens it. When the channel is open, the tide comes up regularly all the way to the anicut ; we have thus salt water on its lower side, and fresh water on the upper side ; the level of the salt water at high tide being generally only about three feet below the level of the fresh water, large fish can readily pass up the stream. There is no obstruction whatever to their passage up when the river is flooded, as at such times the surface of the water is perfectly level on both sides of the anicut. If the land on the opposite side of the river could be purchased, as has been suggested, for use as a stock-farm, the whole rights to the river over two miles of its length would thus be secured for experiments in pisciculture. Nothing really satisfactory can be done in utilizing the portion of the river belonging to the estate, until the purchase suggested has been effected, or until the law sufficiently protects fish.

37. I have endeavoured during the past four years to protect the fish in our fresh water from wanton destruction. The result has, I consider, been very satisfactory. I had a portion of this water netted in the beginning of last year and found that there was an abundant stock of fish, some hundredweights having been brought ashore ; the variety of fish most common was one resembling very much an English roach known to natives as "Sale;" it is a handsome fish averaging from 1½ to 3 pounds in weight ; another variety very abundant was a fish known to natives by the Tamil name "Aery Valay ;" it is a long fish varying in length from 20 to 30 inches, and weighing from four pounds up to seven pounds, both of these varieties are highly esteemed by natives.

38. There is at present, I believe, an enormous waste of human food by the reckless way in which our tanks and rivers are fished ; the majority of the nets used are not more than a quarter of an inch wide in the mesh, while many nets are used of a much smaller mesh, consequently a large quantity of young fish are taken with those of a more useful size, the best are selected, and those too small to be of use are rejected and left on the spot where the net is emptied. I do not remember ever having seen a native fisherman return to the water the small fish not required by him, all act with perfect disregard to the future ; unfortunately the anicuts, weirs, and other impediments in the channels of rivers made for irrigation purposes have rendered it much more easy for the fishermen of the present day to slaughter fish than formerly was the case.

39. *The Field-Laborer.*—One of the first results that will be secured by the gradual adoption of a better practice in Indian agriculture will be an improvement in the condition and prospects of field laborers. At present the condition of this numerous class of people is most unsatisfactory ; not only are their individual earnings exceedingly small, but they are very irregular in amount. In the best seasons of the year the income of the field laborer is but just sufficient to meet the requirements of himself and family ; in unfavorable seasons, these people are in a very destitute state.

40. The ryot employer of labor treats his employés like he treats his cattle ; at the end of the cropping season, or when the weather is unpropitious for out-door employment, he turns them away to depend on their own resources. In most parts of the Presidency the laborer is generally paid in field produce. In the neighbourhood of Madras the annual remuneration given to an adult field laborer, in the employ of a ryot, is two Pagodas, or seven Rupees, and one cloth yearly, and three meals of food per diem. When the laborer is sick the daily supply of food is stopped.

41. On the Sydapet Farms the laborers are paid at the rate of five Rupees per mensem for ordinary men and six Rupees per mensem for ploughmen, but they are paid only when actually employed. Excluding Sundays, most of them lose one month in the year from attacks of fever and other sickness ; the total income earned by the ordinary laborer is, therefore, in most instances, only about four Rupees per mensem, out of which it is frequently necessary to pay house-rent. Sometimes the wives of the laborers work in the field, but their earnings on an average in the year will not add more than a Rupee per mensem to the earnings of their husbands, in such instances bringing the total income of the family up to say Rupees five per mensem, with which must be purchased everything needed.

42. The frequent attacks of sickness to which people of this class are exposed, and the absence of all income at such times keeps them nearly always in debt to the bazaarmen. During an outbreak of disease in a district or when food is scarce and dear, it is not at all surprising that such great numbers of these people die.

43. As long as the present low agricultural practice is the ordinary practice of our ryots, there is but little hope of any improvement being made in the condition of their field laborers When, under a more enlightened practice, our ryots begin generally to grow the more valuable kinds of field crops, there will be some hope that the condition of the laborers will be somewhat less miserable than at present.

44. *Live Fences.*—The appearance of the country might be greatly improved if our ryots could be induced to plant live fences around their fields ; such fences would be of use in many ways, they would protect crops from damage by trespassing cattle, they would moderate the force of the wind, and lessen the losses that are sometimes experienced about harvest time from the effects of storms ; they would render the herding of cattle and sheep unnecessary, and be of use in many other ways, but their chief use would be to afford fuel for domestic purposes, the cattle dung now used by the ryot as fuel being set free for use in a legitimate way.

45. There are many kinds of shrubs admirably adapted for forming fences, each suited to the various conditions met with in different parts of the Presidency. One of the most generally useful is the corkapilly (*Inga dulcis*) which resembles the English hedge-thorn very much in general appearance, and which has been grown on a considerable scale on the Sydapet Farms. A hedge of this shrub can be raised at a very moderate expenditure of labor, it is only necessary to dig a trench about 1½ feet deep and 12 inches wide along the line of the proposed fence, and to fill this trench with a mixture of good surface soil and any manure that is available ; when this is done the seed is to be sown, say in three parallel lines at equal distances in the trench. If the seed is put down with the first showers of the monsoon, it will be unnecessary to use water ; if, however, sowing is done in the dry season, which perhaps the ryot will find the most convenient time in the year, he having then no urgent field-work to engage his attention, it will be necessary to apply water regularly until the seedlings are at the least one foot in height ; but good treatment is not lost on a hedge of this kind ; a fence that is properly started is always the least costly to maintain in good order. After the second year the hedge may be cut regularly once a year, and will yield a large quantity of excellent fuel. When established, a mile of such a fence under fairly good treatment in a climate similar to that of Madras will yield annually from 30 to 40 cart-loads of cuttings, most of which would be well suited for use in the house of the ryot. The cutting should be done only after the monsoon has passed over, thus securing the fences, when at their full height, to protect growing crops from the ill effects of the high winds that prevail during the monsoon.

46. *Deep and shallow cultivation.*—Some most mischievous opinions have recently been spread through India regarding the effects of deep cultivation in hot climates ; I feel it my duty, therefore, to state most unreservedly that the result of my six years' experience in actual cultivation in one of the hottest parts of Southern India has convinced me beyond all doubt that the advantage that the Madras farmer will secure by deeply tilling his soil can scarcely be overrated.

47. Shallow cultivation is the curse of Indian agriculture, and the man who can induce the ryot to add an extra inch or two to the depth his tillage operations extend, will be as much entitled to the gratitude of his country, as the man who makes two blades of grass to grow where only one grew before.

48. Now in referring to deep cultivation or deep tillage I do not necessarily mean deep ploughing ; it is here, I believe, where the mistaken opinions before noticed have originated. By deep tillage or deep cultivation I mean that the soil must be deeply stirred or loosened by the cultivator, the subsoil plough, &c. As a general rule all soils will be benefited that are thus

treated; but the case is different with deep ploughing when the soil is unfitted, as there are many soils that would be temporarily injured by being suddenly deep ploughed, such soils for instance as those resting on a tenacious soapy subsoil, which in the process of deep ploughing would be brought to the surface and would render the surface soil unproductive until physical and chemical agencies had again restored it to a condition fit for the growth of crops; and it would be equally as unwise to bring up to the surface, by working the plough more deeply, portions of a subsoil which is poorer than the surface soil, or that is calculated to injure the surface soil in its physical character.

49. As a general rule deeper ploughing should be done gradually, that is, the process of deepening should be the work of time, though there are soils that may be deepened at once without any bad results following. It should be remembered that in deep ploughing the under soil is always brought to the surface, while in deep cultivation the under soil or subsoil remains in its original position, its particles being merely loosened, thus allowing a free passage for air and water.

50. A dry season brings out in a decisive way the results of deep culture; during the long drought experienced last year the maize plants growing on a piece of land on the Experimental Farm that had been subsoil drained in the previous year, were more than twice as large, and proportionately luxuriant that grew over the newly-filled drains, than the plants that grew on the land between the lines of drains, the former during the greatest heat were always remarkably luxuriant, they drew their supplies of moisture far down below the parched surface soil, while the plants on the intervening spaces were puny and sickly, their roots not being able to penetrate more than a few inches below the parched upper soil. Similar results I have always obtained whenever I have had the soil deeply cultivated. I have gradually year after year deepened the cultivation on the Sydapet Farms until the soil is fully 50 per cent. deeper than similar soils under ordinary native farming, and I would gladly go deeper still; indeed I feel sure that we can never secure good average results from our farming until we do cultivate deeper. In the hottest season the crops on the deeply tilled soil are generally fresh and luxuriant in appearance, while those growing on shallow soils are parched and withered.

51. *Want of enterprise in the Ryot as shown by his carelessness regarding the quality of the field seeds he sows.*—Native cultivators pay but little attention to the quality of the seed they sow; this neglect is the result of ignorance or apathy, it cannot be said to be the result of want of means—the too common apology offered for all the shortcomings of the ryot—for in many cases a little personal labor expended in separating the seed is all that is required. The extra cost of the seed for an acre of land of the quality it is advisable to sow would seldom be more than one rupee, while the return obtained from this seed may be many rupees greater than the return from inferior seed.

52. Again native cultivators will persist year after year in sowing seed the produce of their own land, rather than put themselves to the trouble of sending a few miles for fresh seed the produce of soils of a different description to those they cultivate.

53. There are those who profess to believe that the ryot is a sharp-witted man, keenly alive to his own interests, and these persons are frequently informing us that if agricultural reformers could but show the ryot how to make money by adopting improved practices in agriculture, he will be found most ready and willing to receive and act upon any advice given to him; but this is a mere delusion; ignorance, superstition and custom are not less powerful in India than in other countries. More is needed to fit a man to make money than a mere desire to possess it; most people possess this qualification in plenty, yet all are not rich. The fact is, that in no industry, can ignorance and prejudice produce such serious consequences as they do in agriculture. Intelligence and enterprise are essential to success in modern agriculture.

54. The loss that results from the use of bad seed and from thick seeding will, I have little doubt, annually represent a sum equal to, at the least, one half of the sum paid per acre in the form of Government assessment on the arable land of this Presidency; in other words by the

exercise of a little intelligence, and by the expenditure of a small amount of labor, most Ryots holding arable land could reduce their annual assessment fifty per cent.—a result which I should imagine all would be glad to secure—and yet how few there are who could be induced to put in force the means required to produce these results.

55. It is education, not example, that is at present so urgently needed to improve Indian agriculture. Educated intelligent men will follow a good example ; but ignorant superstitious people never will, they prefer to trust to witchcraft, magic, &c.

SYDAPET EXPERIMENTAL FARM.

56. *Cattle.*—With the view of effecting some improvement in the cattle of the district around Madras, it is intended to import a few animals of the Aden breed. One bull, two cows, and two calves have been purchased, for shipment from Aden to Madras by the first favorable opportunity. The Adens have a high reputation as dairy animals ; the name Aden by which they are distinguished has probably originated from Aden being the port from which cattle of this breed are generally shipped, they are not found in the neighbourhood of Aden, but are brought from districts situated at considerable distances from the coast. They are small animals, and the bulls of the breed are therefore better suited for use in the early stages of experiments in improving the breeds of small cattle generally found in Southern India than are bulls of the Nellore and Mysore breeds, which in some instances have been used for this purpose. To show how great a mistake it is to use bulls of these large breeds in attempting to improve the cattle of Southern India, it is only necessary to mention that a cow of an average size generally weighs from 200 to 300 lbs. live weight, while a good bull, of the Nellore, or Mysore breed will weigh from 900 to 1,000 lbs.

57. In attempting to improve breeds of cattle, great care should be exercised in order that the increase in size bears a strict relation to the supply of food available. In most parts of this Presidency during the dry months, even in a moderately good season, the food available is scarcely sufficient to preserve the lives of the undersized cattle kept by ryots, and would, therefore, be totally inadequate to do even this much for animals of a larger size.

58. Before taking steps for improving the size of the cattle in the more backward parts of the Presidency, it is necessary that something should be done to induce ryots to grow fodder, &c., as food for their live stock. As long as so many ryots consider that it is more economical to allow their cattle to starve or even to die in the dry season rather than to go to the trouble of growing fodder for their use, it will be exceedingly unwise to attempt to increase the size of the cattle they keep.

59. The increase in the size of the draught cattle of Southern India is highly to be desired ; greater size means more strength, deeper cultivation, better crops.

60. Native cattle like native laborers can adapt themselves readily to the bad conditions with which they have so frequently to contend. A cooly, while work is abundant and food cheap, takes his three meals per day ; as the work becomes less abundant or food dearer he reduces his allowance to two meals per day, and he will manage to exist even on one meal per day when out of employment or food is very dear. The starving process is gradual ; the people become accustomed to it. It is the same with cattle ; they can be starved down to, and be kept alive, for a time, on a daily allowance of food that would represent only a tithe of the quantity they could consume when in full health. This is the ordinary process to which they are subjected every hot season at the hand of their owners. But while it is possible to reduce gradually the daily food of a bullock until in amount it would not be one-tenth of the allowance that should be given, it is not so easy again to increase without injury the daily allowance of food to the quantity necessary to support the animal in health ; hence the enormous losses that are experienced in this country amongst live stock when after a long drought a sudden fall of rain produces a luxuriant and plentiful

growth of grass. Few cattle die directly from starvation; the deaths in most cases are the result of the sudden supply of succulent food in abundance, greedily eaten by animals whose constitutions have been weakened by a long and gradual starving process.

61. It has been suggested that a stock breeding and dairy farm should be attached to and worked in connection with the Experimental Farm ; to be employed as a portion of the Educational Machinery to be used in training agricultural pupils. It is certainly very desirable that due attention should be given to stock breeding and dairy farming here, not merely for the reasons given, but also because these important branches of agriculture greatly need attention, and they will never receive proper attention until Government has led the way and shown in what direction improvement can be effected.

62. Fortunately there is a piece of land available, measuring about 300 acres which is separated from the Experimental Farm only by the river Adyar. It is true that the river when in flood will prevent intercourse between the two farms excepting by means of the bridge at Sydapet, but this would only be for a few days in the year, and would be but a trifling inconvenience in comparison with the advantages that the proximity of the river confers on the site. The land is not at all of the quality I should select for a grazing farm ; a portion of it is a good average soil, but much the largest area is very inferior. The great advantage the site possesses is its proximity to the Experimental Farm, thus rendering it unnecessary to erect special farm buildings, and enabling the undertaking to be managed under the direct control of the officer in charge of the Sydapet Farms. The land is capable of much improvement, and this improvement could be effected at a cost sufficiently moderate to justify the expenditure, provided the land can be purchased at a price bearing a just relation to its present condition.

63. The operations of such a farm might begin by buying up the best of the calves born in Madras, of which there are a great number every year, most of which are at present turned to no useful account. The cows are in most instances the property of residents whose only anxiety is to get as much milk as possible. As many of these cows are good specimens from the best districts, while a small number are animals that have been imported from Australia, their calves are well worth attention, and they could, I think, be purchased at very moderate prices.

64. After the undertaking has been organized, attempts might then be made to establish a herd suited to the requirements of the district.

65. Probably in the good grazing districts of the Presidency in Salem or Nellore, better results might be obtained in stock breeding than at Sydapet, and it might be well in these districts to start some such undertaking ; but we need to commence our educational work at once, and we seem to have in the land referred to many important advantages which a site in the more remote parts of the Presidency would not possess. It seems unnecessary to refer to this matter at greater length, as I have already prepared a separate report on this subject.

66. *Sheep.*—The sheep breeding experiment continues to progress in a satisfactory way. There is a decided improvement in the quality of the wool now obtained from our sheep ; when we commenced the experiment the wool yielded by most of them was exceedingly coarse and almost quite straight ; it is now finer and is a great deal more curled. There is, of course, very much yet to be done before the average quality of the wool is even moderately good, but the improvement that has been effected is very encouraging.

67. At one time I feared that in this hot climate but little could be done towards improving the quality of wool ; but though the intense heat is a great drawback we possess one advantage over people resident in a cold climate in being able to grow crops throughout the year for the use of sheep, and this is a very important advantage in wool growing. When sheep are alternately starved and overfed, their wool is always very irregular in strength and quality, the portion of the staple produced during the period when food was scarce being always weak.

68. As our experiments have shown that we can produce green food throughout the year, I now see no reason why we should not ultimately produce fine wool ; it must be remembered that

some of the finest wools produced in the world are grown in countries in which the temperature has a high average range; for instance in Spain, Southern Germany, the Southern States of America, the Northern Districts of Australia, &c.

69. It will, of course, take a long time to produce a fine wool from the Sydapet breed of sheep; but by judicious crossing with fine wool-producing breeds that will stand the intense heat experienced in Madras during the hot season, we may bring about the desired results in much less time.

70. I hoped that the Chinese breed of sheep would have proved useful for this purpose, and accordingly obtained recently from China three ewes and two rams, but they will not, I fear, be able to encounter the heat of Madras; they already seem to suffer greatly. The wool of these sheep is very much superior to anything that we have yet produced at Sydapet; we may, therefore, hope if these Sheep, live to effect some considerable improvement in the quality of our wool. It is chiefly in the wool that these Chinese sheep are superior; they are not better animals for the butcher than are the Sydapet sheep, and their broad flat tails do not add to their value. If these imported sheep live, experiments will be made by putting the rams to a few selected ewes of the Sydapet breed, while a ram of the Sydapet breed will be put with the ewes of the Chinese breed. I hope that the latter cross will result in the production of lambs with tails of the ordinary size, as the heavy flat tail is a great disadvantage, it so frequently becomes diseased.

71. *Pigs.*—Four pigs, two boars, and two sows were recently imported from the south of China, and are now on this farm; they, like the Chinese sheep before alluded to, appear to suffer greatly from the heat. There are two principal breeds of pigs in China, a large and a small breed; it is the latter that we have introduced. The pigs kept at this farm are rather too large for killing as pork; it is hoped that a cross with the Chinese will result in a variety more suited in size to meet the general demand.

72. If pigs receive proper attention, there is, I believe, no more useful agricultural stock in this country. As generally managed by natives, pigs are the scavengers of the village; hence the disrepute into which country pork has fallen. It should, however, be generally known that the cattle and sheep of the ryot, when kept in a half famished state, are quite as filthy in their habits. Pigs that are properly housed and fed are almost as cleanly in their habits as are cattle or sheep under similar condition.

73. I have before recommended pigs as suited for keeping to supply the wants of European households on coffee estates and in other places where it is almost impossible to get butcher meat fit to eat, and I would again direct attention to the matter; pigs can be reared under conditions quite unsuited for rearing sheep, and under artificial feeding a pound of pork can always be produced at a cost very much lower than a pound of mutton.

74. *Cotton.*—When I first attempted to grow cotton on this farm, I was frequently informed that the experiment could yield no good results, as it had been ascertained beyond all doubt that the climate of the district was altogether unsuited for the healthy growth of this plant; while general experience had proved, in an equally conclusive way, that cotton could not be raised on a poor sandy soil such as that which forms so considerable a proportion of this farm.

75. This opinion was very general, thus the Collector of Chingleput in a report to the Board of Revenue, dated 7th June 1869, explaining why he had failed in getting any cultivator to take some cotton seed which had been sent to his office for distribution, says: "Due notice was given in the District Gazette, and the various farmers and proprietors were invited to apply for the seed, but no applications were received, the fact being that in this district little or no cotton is grown, the soil being quite unfitted for it." Again the Honorary Secretary to the late Farm Committee, in a report, dated 23rd June 1869, explaining to the Board of Revenue why certain cotton seed sent by the Board for experimental cultivation had not been sown, says: "The soil of the Government Experimental Farm at Sydapet is of a very sandy description, and the Committee considered it was useless to try the experiment of growing cotton."

76. I was, however, not satisfied to let the matter rest here. I believed that far too much trust was placed in the opinions expressed by the ryots of the neighbourhood; I found on comparing the meteorological registrations of the district with those of the regular cotton-growing districts that there was nothing in the climate prejudicial to the growth of cotton, while the soil, though very much inferior to the so-called cotton soils, could, I believed, by the aid of manure, be rendered sufficiently fertile.

77. My first experiments were made on a small scale; the results afforded were very encouraging. I repeated the experiments again and again, each time on a larger scale, and now cotton is one of the ordinary crops of this farm. The variety I prefer is the New Orleans; it is especially suited for high cultivation to which it has long been subjected; a dressing of manure that would be necessary to render our inferior soils fit for producing cotton would cause plants of the indigenous variety to run to stem and leaf instead of increasing the yield; whereas the yield of the New Orleans plant under similar circumstances would be largely increased.

78. It is true that on inferior soils such as we have here cotton cannot be raised without the aid of manure, whereas on the more fertile soils of the districts in which cotton is grown it can be produced without manure; but the yield is always very small, seldom more than one-fourth the quantity that could be raised on the same soil if properly cultivated and manured. On the Experimental Farm, crops that have yielded 200 lbs. and upwards of clean cotton per acre have repeatedly been produced, while the average produce in the cotton districts is only 75 lbs. of clean cotton per acre.

79. There are thousands of acres of land around Madras in no way inferior to the soils of this farm, now lying bare during two-thirds of the year, and during the remainder producing wretched crops of varagoo and horse gram, which might be made to yield remunerative returns under cotton; the extra expense on cultivation and manure would be morethan counterbalanced by the smaller cost of conveying the cotton to the shipping port.

80. I have in former reports given full and minute details of the cultivation, &c., of the experimental cotton crops which have been grown here, but I have not been able until now to place on record anything showing the *quality* of the cotton raised further than what could be gathered from the price obtained in the local market. I was enabled through the kindness of Messrs. Walker & Co. of Madras to forward to England for sale three bales of cotton that had been grown on this farm on a soil containing nearly 90 per cent. of sand. The following correspondence refers to this cotton:—

To W. R. ROBERTSON, Esq.,
Supt. Govt., Farms, Sydapet.

Dear Sir,—We beg to hand, herewith, extract from letter received by us yesterday from our London Office, giving Brokers' report and valuation of the three bales cotton received from the Government Farm and shipped by us per *Sultan* to London. You will observe the staple is complained of as "weak," and we think this is owing to its having been torn in the process of ginning. We might mention that while your cotton is valued at 6½*d.* per lb. we have sales of Fair Western's by same mail at 6*d.* per lb.

Madras,
17*th November* 1873.

We are, &c.,
(Signed) WALKER & Co.

"We hand you as under our Brokers' report upon the three bales cotton per *Sultan*." G. F. W. Co.

"We have carefully examined the sample of three bales cotton ex *Sultan* at Madras, and find it to be of an useful description of Salem character, ginned, fair color, silky, but rather weak staple, and worth about $6\frac{5}{8}d.$ per lb.

"This is the value which cotton of this quality would command to-day were it here in any quantity, say 50 or 100 bales. The color is good and the cotton is clean, but our Brokers complain that the staple has been somewhat injured; they presume in the process of ginning.

"I have ordered the three bales to be sold by public auction with other cotton, as the best means of ascertaining its value. But in this small quantity it is less valuable than in a lot of 50 or 100 bales."

LONDON,
24th October 1873. (Signed) WALKER & Co.

81. Unfortunately at the time the cotton reached London the markets were unusually low, or the price realized $6\frac{1}{2}d.$ per lb. would have been higher, still in comparison with the rates then prevailing the price obtained was very satisfactory; the following are the rates at the time for other varieties of cotton:—

Variety.	Price per lb.
	d.
Tinnevelly	$6\frac{1}{2}$
Dhollera	$6\frac{1}{16}$
Western	6
Cocanada	$5\frac{7}{8}$
Bengal	$3\frac{7}{8}$
Rangoon	4
American cotton, New Orleans	$8\frac{1}{2}$

82. I find that there is a considerable improvement in the quality of the cotton produced on the farm; it is both longer in the staple and more soft and silky than the cotton raised in our first experiments in 1871-72 when the seed was newly introduced.

83. The following results show the quantity of clean cotton now obtained from the New Orleans seed cotton:—

Date ginned.	Seed Cotton ginned.	Clean Cotton obtained.	Yield of clean Cotton per 100 lbs. of Seed Cotton.
	lbs.	lbs.	lbs.
August 10th	229	73	31·88
,, 28th	409	130	31·78

The average yield of 31·83 lbs. of clean cotton for every 100 lbs. of seed cotton is very satisfactory, seeing that the best indigenous cotton does not yield more than 25 lbs. of clean cotton for every 100 lbs. of seed cotton.

84. The Egyptian cotton plants to which I referred in my last report are still growing; judging from their present appearance they will retain their full vigor much longer than plants of the New Orleans variety. I have now had another year's experience in growing Egyptian cotton, and see no reason to alter the opinion I formed at the end of my first year's experience, viz., that this variety is a more expensive crop to grow than New Orleans. As I before pointed out it is impossible to use cattle in a field of Egyptian cotton unless the plants are growing in lines very far apart, as the branches instead of growing upwards like those of the New Orleans plant grow chiefly in a horizontal direction. Perhaps by careful pruning during a few years the

plants may be induced to grow in a more upright way. From the length of time the cotton crop is on the land frequent cultivations are required during its growth, while as weeds spring up so freely, under the light shade afforded by the cotton plants, frequent weedings are also very necessary, and the cost of performing these operations is nearly doubled if manual labor instead of cattle power is used. The yield of cotton obtained from these plants during the last year was small, but to some extent the character of the season would account for this. In the ease with which this cotton can be separated from its seed, it possesses one advantage over all the varieties of cotton that have yet come under my notice.

85. I fear very much that we will lose the variety of cotton known as the Yca Valley to which I have so frequently referred in former reports, the borer before noticed continues to commit great havoc amongst the plants, the shrubs have again and again been pruned of all their affected branches, which have been collected and burnt, but in spite of every effort the borer has continued its depredations, and many of the plants are now reduced to little more than bare stumps; the ground on which they are growing has been thoroughly cultivated and various manural dressings have been applied, but the effect was only to stimulate the growth for a time the extra luxuriance produced, apparently only affording greater scope for the depredations of the borer; we may succeed in getting rid of this pest, but if we do the seed raised from these plant in their debilitated condition will scarcely be fit for distribution.

86. The Yca Valley cotton is undoubtedly a very valuable variety; it would be well if a supply of fresh seed could be obtained from Brazil; it is not likely ever to become one of our ordinary field crops; but as Indian agricultural practice improves, this variety of cotton would take its position amongst our more valuable crops.

87. *Maize and Cotton.*—The following details refer to the cropping of the field that was recently drained, noticed under heading "subsoil drainage" in another part of this report, where will be found all details referring to the drainage operations performed.

Plot (*a*).
Drained by stone drains.
Area of plot, 8,800 square yards.

Preparation of the soil, &c.—The soil after being thoroughly worked and cleaned was ridged. Blood manure (a compost formed of ashes and the refuse of the slaughter-house) was then spread between the drills, the total quantity used was 36 cart-loads. The ridges were next split by the plough, one-half falling over the manure on either side, thus forming new ridges with the manure beneath, these ridges were next consolidated by the chain harrows when the land was fit to receive the seed.

Seed, &c.—On the 17th of September the whole of the plot was sown, the seed being placed on ridges which were about 30 inches apart. A line of cotton was sown alternately with a line of maize throughout the whole plot. The quantity of seed sown was :—

Maize 8½ pounds.
Cotton 8½ ,,

After cultivation.—During the growth of the crop the land was ploughed twice and hand-hoed three times.

Harvesting, &c.—The maize matured and was ready for gathering in the middle of December. The cotton crop was longer in coming into bearing, and as the weather was so exceedingly dry several months passed over before the whole crop was gathered. The maize yielded 4,147 cobs; and from the cotton plants 299½ lbs. of seed cotton was collected. When dry four of these cobs on the average yielded one pound of clean maize; one hundred pounds of the seed cotton yielded on the average 31½ pounds of clean cotton. The weight of the straw, cob skins, &c., were estimated, but these estimates were based on actual results.

88. The following statement shows the financial results of the experiment calculated per acre :—

Expenditure.	RS.	A.	P.
Ploughing and cleaning the soil	3	0	0
Ridging	0	8	0
Ten tons of blood manure	10	0	0
Carting and spreading manure	2	0	0
Splitting ridges	0	8	0
Chain harrowing ridges	0	2	0
Seed and sowing	1	0	0
Chain harrowing ridges to cover seed	0	2	0
Cultivation during growth.			
Two ploughings and three hand-hoeings	6	0	0
Scaring birds, &c., at harvest	1	0	0

Average cost of harvesting Maize.

	RS.	A.	P.	RS.	A.	P.
Gathering cobs	1	8	0			
Carting to sheds	0	6	0			
Peeling, tieing, hanging, &c.	1	8	0			
Shelling	0	8	0			
Reaping and carting straw to yard	1	12	0			
				5	10	0
Gathering and ginning cotton				7	0	0
				36	14	0

Income.	RS.	A.	P.
570 lbs. of maize seed at 30 lbs. per Rupee	19	0	0
52 lbs. of clean cotton at 120 Rupees per candy	12	7	8
112 lbs. of cotton seed	2	3	10
793 lbs. of cob stalks, skins, &c.	1	15	9
2,956 lbs. of straw	13	3	2
	48	14	5

General Result.	Per.	Acre.	
Income	48	14	5
Expenditure	36	14	0
	12	0	5
Deduct annual charge for drainage	4	0	0
Margin to pay rent, interest, superintendence, &c.	8	0	5

This surplus might fairly be increased to Rupees 12 by adding Rupees 4 to represent the unexhausted value of the manure used.

(*Plot b.*)

Drained by two-inch pipe drains.

Area of plot, 8,742 square yards.

Preparation of the soil.—The soil was prepared in the same way as the soil of plot (*a*). Twenty-one cart loads about 10½ tons of blood manure and 54 parahs of lime were applied to the plot.

Seed, &c.—On the 4th of September the plot was sown, 11 lbs. of maize and 9 lbs. of cotton seed sufficed for sowing the whole plot. The sowing was effected in the same way as described in referring to the sowing of plot (*a*).

After cultivation.—Two ploughings and four hand-hoeings were all the after cultivations performed.

Harvesting.—The maize did not mature until the beginning of January ; the cotton was not all gathered until several months after. The maize yielded 5,728 cobs, and the cotton yielded 404½ pounds of seed cotton. The yields of clean maize and of clean cotton were very similar to the yields obtained from the produce of plot (*a*) ; and the weight of straw, &c., were calculated from the data used in calculating the weight of straw, &c., in plot (*a*).

89. The following statement shows the financial results of the experiment calculated per acre ;—

Expenditure.			Rs. A. P.
Ploughing, cleaning the soil			3 0 0
Ridging			0 8 0
5¾ Tons of blood manure compost			5 12 0
27 Parahs of lime			7 14 0
Carting and spreading manure			3 8 0
Splitting ridges and ridging			0 8 0
Chain harrowing ridges to consolidate the soil			0 2 0
Seed and sowing			1 0 0
Chain harrowing to cover seed			0 2 0
			22 6 0
Cultivation during growth.			
2 ploughings between rows of plants 4 hand-hoeings.			7 8 0
Scaring birds, &c.			1 0 0
Average cost of harvesting Maize Crop.			
	Rs. A. P.		
Gathering cobs	1 8 0		
Carting	0 6 0		
Peeling, tieing, hanging, &c.	1 8 0		
Shelling	0 8 0		
Reaping	1 0 0		
Carting straw	0 12 0		
			5 10 0
Gathering cotton, ginning, &c.			10 0 0
			46 8 0
Income.			Rs. A. P.
793 lbs. of maize seed at 30 lbs. per Rupee			26 6 11
70 lbs. of clean cotton at 120 Rupees per candy			16 12 10
153 lbs. of cotton seed			3 1 0
1,104 lbs. cob stalks, skins, &c.			2 12 2
4,112 lbs. of straw			18 5 9
			67 6 8
General Result.			
			Per Acre.
Income			67 6 8
Expenditure			46 8 0
			20 14 8
Deduct annual charge for drainage			3 0 0
Margin to pay rent, interest, superintendence, &c.			17 14 8

To this surplus Rupees 5 may fairly be added as the value of unexhausted manure, making the return Rupees 22-14-8 per acre.

90. Satisfactory as are these results, they do not fully exhibit the benefits in this instance gained by subsoil draining, for it must be remembered that before the drainage was performed the land was almost hopelessly unproductive having been rendered so by swamp cultivation. The stoppage in the stone drains in plot (*a*) during the latter growth of the crop undoubtedly lessened the return that would otherwise have been obtained.

91. With further experience I feel sure that pipes will be found much more suited than stones for use in subsoil draining in this part of India.

92. Throughout the long drought which was experienced during the year under review the cotton on the pipe drained land was always green and fresh, while that growing on the undrained soils was withered and much blighted.

93. I feel no doubt whatever regarding the benefits that will be secured by the subsoil drainage of retentive soils in this part of India, but I believe that we have yet much to learn before we can venture to recommend a system of subsoil drainage for general adoption.

94. *Burmese Paddy.*—A few pounds of each of the best kinds of Burmese paddy were obtained from Rangoon. Each variety was sown on a separate plot of land, the cultivation adopted was precisely that under which indigenous paddy is placed. The general results were not good, a large number of the plants produced small inferior grain, but this may to some extent have been the result of the great change in climate, especially as the crops matured in the early part of the dry season, at which time the dryness of the air in Madras affords a very marked contrast to the state of the atmosphere most common in Burmah. Probably the grain produced by these crops will afford a seed that will yield better results next season. These varieties of paddy are much more highly esteemed by natives than the ordinary paddy generally grown in Southern India.

95. *Shamay* (*Panicum Miliare*) *as a fodder crop.*—A plot of land measuring 744 square yards was sown with 10 pounds of Shamay seed on the 2nd of August. The crop grew rapidly and with great luxuriance ; on the 25th of October, when most of the plants were coming into ear, the whole was cut down, and yielded 4,575 pounds of excellent fodder. This was dried and made into hay which, when cured, weighed 1,411 pounds. After the removal of the first cutting the plants again started vigorously, and on the 18th of December another cutting, weighing 2,673 pounds, was obtained. This, when dried, yielded 925 pounds of hay. The total return thus obtained from the plot during the four months that elapsed between the sowing of the crop and the harvesting of the second cutting was 7,248 pounds of fodder, which gave 2,336 pounds of hay, equal to 47,151 pounds of fodder, or 15,197 pounds of hay per acre.

96. The cultivations, &c., were as follows :—

2 Ploughings.
2 Harrowings.
2 Weedings.
7 Waterings.

Manured with four cart loads of fold yard manure.

97. The cost of the foregoing per acre may be estimated as follows :—

	Per Acre.		
	RS.	A.	P.
Ploughing and other cattle labor	2	8	0
Manure and carting	23	4	0
Seed and sowing	3	0	0
Weeding, &c.	3	0	0
Watering seven times	7	0	0
Cutting fodder, &c.	2	0	0
	40	12	0

or about Rupees 1-14-11 per ton of fodder, a low price.

98. I should remark with reference to these results that during the time the crop was on the ground the rainfall generally was copious, hence it was seldom necessary to irrigate ; had we been obliged to water the crop regularly throughout the whole time it was growing, the cost of producing the fodder would have been largely increased.

99. *Paddy Fodder—green, and dry.*—I have already directed attention to indigenous paddy as a fodder producer. During the past year we grew a considerable quantity of this fodder ; it is readily eaten by all kinds of farm stock ; when produced on land in a good manural condition it is of course much more nutritive than when grown under the conditions that characterize native farming. It is not so well adapted as a food for dairy stock as is cholum fodder ; a milch, cow when consuming daily 45 lbs. of cholum fodder yielded three measures of milk per diem but when paddy fodder was substituted, though a similar weight was consumed, the yield of milk was reduced to two measures ; when feeding with cholum fodder was resumed, the daily yield of milk again rose to the quantity obtained previous to the change of food. This result is not surprising when the habits of the two plants are compared ; the paddy is an aquatic plant, its growth is rapid provided it meets with a sufficiency of organic food in the soil or in the water in which it is growing, a quantity of available plant food that would suffice for the wants of a paddy crop when irrigated would be altogether insufficient to meet the wants of a dry crop ; irrigation water, judiciously applied, enables a plant to utilize thoroughly the food in its neighbourhood, not only by rendering that food more fit for assimilation, but by bringing it within reach of its roots. Dry crops, such as cholum, &c., grow steadily during favorable weather ; as their roots have but a very limited feeding ground, merely the portions of the soil with which they are in contact, it is of the utmost importance for their healthy development that the soil should be rich in plant food, much greater in proportion than is requisite in a soil under a crop of paddy.

100. Under proper manuring and careful watering the nutritive value of paddy fodder might be considerably increased, there can, I think, be no doubt, but that the most nutritive paddy fodder that could be raised would be that produced by the least expenditure of water, especially if the field was occasionally allowed to dry for a day or two in order to admit capilliary action to exert its influence in bringing up to the surface plant food from a lower stratum of soil. Though paddy fodder as generally grown is inferior to cholum fodder, there are many circumstances under which it can be raised more easily, hence its value. For making hay for future use it is decidedly preferable to cholum, not only can it be packed more readily in stacks, but it can be kept in good condition for a much longer period.

101. Paddy hay when made into chaff is a useful food for horses ; the following experiment shows the cost of this hay and the cost of chaff made from it :—

	lbs.
Weight of green fodder weighed two hours after being cut...	4,396
Weight of hay after having been exposed 42 hours, during which time it was repeatedly turned and tossed	1,459

Expenses—

	Rs.	A.	P.
Green fodder 4,396 at 400 lbs. per Rupee	10	15	10
Cost of winning and chaffing	3	0	0
Total...	13	15	10
Cost of chaffed hay per ton	13	15	10
Cost of hay per ton	11	15	10

102. *Indigenous Grasses.*—In response to a circular issued from the Board of Revenue a large quantity of seed of indigenous grasses was sent to Madras for experimental cultivation on the Sydapet Farms. Many experimental plots were sown with these seeds, but from various causes the results obtained were unsatisfactory, and but ill repaid the expense and trouble incurred. One chief cause of the want of success was that too much was attempted. I was afraid to keep the seed, the length of time that some would have to be kept, in order to allow of a series of manageable experiments being conducted in succession, and therefore attempted to deal with the whole at one time, sown in upwards of one hundred experimental beds. I soon ascertained that the experiment was far too extensive for the means then at my command, and that it could not receive justice unless by neglecting other experiments. A large quantity of results were collected, which, though unsuitable for report now, will be of use in the further experiments that I intend making; these I propose shall deal only with grasses of one district at a time, instead of with the grasses of the whole Presidency.

103. Another cause of the unsatisfactory results yielded by these experiments was the injury done to the experimental beds by donkeys belonging to dhobies resident in Sydapet. These animals were evidently turned into the field through the gates by their owners, as the fences were in sufficiently good condition to prevent trespass. The donkeys were, of course, captured and sent to the pound whenever seen, but during night many visited the plots, and were removed again before daybreak. Some of these donkeys were captured two or three times a week, and regularly sent to the pound, when they were, with the same regularity, sold, and bought again, probably by their former owners, at from 2 Annas to 3 Annas each, when they again returned to pasture on the grasses growing on the experimental plots. Of course no dhobie could afford to keep up this practice of buying the same donkey two or three times in a week, and to some extent our perseverance in sending the depredators to the pound had a good effect; but in the meantime nearly the whole of our experiments were rendered useless, as we could not report on the comparative yield of plots under different species of grasses which had been grazed to a greater or less extent. To make quite sure that the animals sent to the pound were really returning again and again I had one or two marked, and in this way placed the matter beyond a doubt. I have dwelt on this matter at this length, because it illustrates the annoyance to which many persons are exposed from animals trespassing upon their land; damage may be done to a serious extent by an animal that possesses almost no value, it may in the usual course be sent to the pound, but when there the owner is sufficiently discreet not to claim it lest he should thereby become liable for the damage it has done; he waits until the animal, in the regular course when on owner is found, is put up to auction, when he or a friend, buys it for a few Annas; thus, for the small sum invested in the purchase he avoids having to pay probably many Rupees for damages done. This may seem a small matter to which to direct attention, but it is these small matters that often prove the most annoying, they are so difficult to deal with in a satisfactory way, and I have met with many persons in this country whose attempts, on a small scale, to introduce new crops have been frustrated from the custom, so common amongst natives, of turning live stock, cattle, sheep, goats, donkeys, &c., upon the public roads to seek a subsistence on the pickings there met with.

104. From the more recent sowings I am able to report a few results obtained from the experiments with native grasses; they do not possess much value, but as a step towards a knowledge of the grasses of the country, they will be of use in future experiments.

105. It must be remembered that indigenous grasses, though their appearance above ground, their flowering season, &c., depends on the periodical rains, all possess habits more or less different; hence it was not the best way of bringing to light their individual qualities by owing all in one kind of soil and treating the whole in one way; still, until we possess more infor-

mation regarding the natural habits of the grasses, a comparative trial under similar conditions is the only way by which anything of a useful character can be learned.

106. The soil on which these experiments were made was a light sandy loam ; it was lightly manured, and water was applied once or twice a week according to the state of the weather. The following are the general results :—

Number of Plot.	Area of Plot.	Local Name.	General Results.				
			When sown.	When appeared above ground.	When flowered.	Yield of fodder cut when in flower.	
						Per plot.	Per 100 square feet.
	Square feet.					lbs.	lbs.
1	45	Melampary	4th June.	10th June.	15th July.	15	33
6	$6\frac{7}{8}$	Pooanthu	4th do.	9th do.	15th Aug.	8	116
7	$5\frac{1}{8}$	Vellai Uttaloo ...	4th do.	9th do.	17th do.	5	94
17	6	Shagappu Shamay...	4th do.	10th do.	7th do.	$3\frac{1}{8}$	52
21	$13\frac{1}{2}$	Chinna Arricum ...	4th do.	11th do.	13th July.	$5\frac{3}{8}$	40
23	$17\frac{5}{12}$	Coopary...	4th do.	10th do.	14th do.	$17\frac{7}{8}$	103
24	$13\frac{1}{16}$	Coranee...	4th do.	9th do.	28th Aug.	8	61
25	13	Varashamay... ...	4th do.	14th do.	15th July.	5	38
30	$6\frac{1}{36}$	Peeshachy	4th do.	10th do.	13th do.	20	166
31	$6\frac{1}{36}$	Pelampury	4th do.	10th do.	13th do.		
41	$12\frac{3}{8}$	Yerri Mylampingee.	5th do.	9th do.	12th do.	5	40
49	10	Punjapoo	5th do.	10th do.	5th Aug.	$1\frac{1}{2}$	15
58	9	Ottaray...	6th do.	12th do.	1st do.	$1\frac{1}{4}$	14
65	$9\frac{1}{8}$	Corranee	6th do.	10th do.	10th do.	$3\frac{1}{2}$	37
71	$5\frac{1}{2}$	Combapree	7th July.	11th July.	12th do.	$1\frac{7}{16}$	26
75	12	Vematherity ...	6th June.	11th June.	13th July.	$2\frac{1}{2}$	21
83	10	Conally...	7th do.	12th do.	1st Aug.	8	80
87	$10\frac{3}{4}$	Chinnyga	8th July.	13th July.	3rd do.	$\frac{9}{16}$	5
90	8						
91	8	Poopillu	8th do.	14th do.	3rd do.	$4\frac{1}{2}$	20
92	6						
100	$6\frac{3}{4}$	Dumapie	7th June.	19th June.	1st do.	$8\frac{1}{2}$	126

Notes thereon :—

Name of Grass.	Remarks.
Melampary	Average height 2 feet 9 inches. Upright growth without bottom grass. When green it yields a fair fodder, but unfit for making hay.
Pooanthu	Average height 2 feet. Upright growth without bottom grass. When young succulent, but wiry when it reaches maturity. Unfit for making hay.
Vellai Uttaloo	Do. do. do.
Shagappu Shamay	Average height 15 inches. Bottom grass abundant ; a moderately good pasture grass ; would afford a coarse hay.
Chinna Arricum	Average height 24 inches. A fair quality of bottom grass. Stems and blades fine, but rather wiry. A moderately good pasture grass. Makes coarse hay.
Coopary..... ..	Average height 24 inches. A coarse grass ; almost useless for pasture or for making hay.
Coranee.....	Average height 24 inches. Destitute of bottom grass. Affords a moderately good fodder, but unsuited for making into hay.
Varashamay...	Do. do. do.

Name of Grass.	Remarks.
Peeshachy.....	Average height 2 feet 9 inches. No bottom grass ; yields a moderately good fodder ; too coarse for hay.
Pelampury	Do. do. do.
Yerri Mylampingee	Average height 12 inches ; a fair quantity of bottom grass ; yields a coarse fodder.
Punjapoo.....	A useless grass.
Ottaray	Average height 12 inches. Has an abundance of bottom grass. Is a moderately good pasture grass. Affords hay of fair quality.
Corranee	Average height 15 inches. No bottom grass. Very wiry ; unsuited for pasture or for hay.
Combapree	Average height 12 inches. Blades coarse and short, but very succulent. Would make a useful pasture grass. Too coarse for hay.
Vematherity	Average height 30 inches. A coarse inferior grass.
Conally	Average height 15 inches. Blades short and pointed. A coarse wiry grass of little value.
Chinnyga	Do. do. do.
Poopillu	Average height 9 inches. A fair amount of bottom grass. Blades and stem tough and wiry.
Dumapie	Average height 30 inches. No bottom grass. Affords a coarse but succulent fodder. Too coarse for making into hay.

107. *Field Vegetable Crops.*—It is exceedingly difficult, in this country, in regard to many crops to determine whether they should be classed as agricultural or garden crops. When I first took charge of the Sydapet Farms I was inclined to rigidly exclude from our attention all crops that did not, beyond all doubt, belong to agriculture ; while I still hold the opinion that in an agricultural undertaking it is well to avoid all vegetable crops that strictly belong to horticulture ; I now think that we may advantageously, in the dry season, give some attention to such crops as plantains, brinjals, sweet potatoes, and one or two other crops of the kind which can be grown on a large scale. There is every year a few months during which there are but few field crops on the land needing attention, and it fortunately happens that this occurs at the time of year when these crops are in season. Crops of the kind referred to consume a large amount of labor, but the return obtained from them is generally satisfactory. They are chiefly valuable to the farmer in enabling him to give regular employment throughout the year to his laborers, a result which is beneficial alike to the laborer and his employer.

108. *Mixed Plantation of Cocoanut and Casuarina Trees.*—A plot of waste land consisting of poor sandy soil, measuring 1,190 square yards, was planted with cocoanut and casuarina trees, partly to utilize the ground, but chiefly as an experiment in view to ascertain the effect on cocoanut and casuarina trees of a moderate dressing of manure. A line of cocoanut trees and a line of casuarina trees six feet apart were planted alternately over the whole plot. The dimensions of the pits for the cocoanut trees were width each way 24 inches, and depth 27 inches ; the pits for the casuarina trees were 18 inches deep and 18 inches wide in each direction. The cocoanut trees had been raised on the farm from nuts ; the trees were fifteen months old when planted out ; they were planted 12 feet apart in the lines. The casuarina seedlings were about three months old, and were bought from a nursery-man at Rupees 5 per thousand ; they also were planted with intervals of 12 feet between each. The planting of the ground took place on the 11th of February 1873 ; there are 134 trees on the plot of which 69 are cocoanut trees. From the time of planting until the 31st of March last the ground has been irrigated twelve times and hoed five times. At the time of planting each pit was manured, four cartloads of blood manure being used for the whole plot ; in February 1874 each tree was manured with two pounds of oil cake, the casuarina trees were pruned nine months after planting, and again in the following March. A few of the trees having failed, they were replaced by seedlings in November last.

109. The appearance of the trees is most promising; their further treatment will be carefully placed on record; it is very desirable that something should be done in order to provide fuel at a moderate price, and in this way set free cow-dung, &c., for use in manuring the soil, instead of as at present, being used as fuel.

110. *Results of inquiries in other countries for crops suited for field cultivation in the Madras Presidency :—*

China.—I am under great obligations to Messrs. Arbuthnot and Co. of Madras for putting me in communication with Messrs. Jardine, Matheson, and Co. of Hong-Kong, from whom I have received much valuable aid. The following extract from a letter received from these gentlemen conveys much useful information, the letter was written in reply to an application I had made to them per Messrs. Arbuthnot and Co. for a small supply of pulses and clovers, or other field-seeds suited for culture in Madras :—" We much regret that we cannot meet Mr. Robertson's wishes as regards a selection of agricultural seeds, for we know of no pulse or clover in China that would prove of much service to him. The beans produced in the Northern Provinces are grown chiefly for the oil and cake they yield, the latter being used extensively throughout the sugar-producing districts of the south. As regards clover, we are only aware of a very coarse description, which is grown to a limited extent around Shanghai, and is almost exclusively used for ploughing into ground intended for wheat or barley."

111. *Burmah.*—An application was made to a gentleman resident in Burmah, who is well acquainted with that country for a supply of field-seeds of the kinds usually cultivated by the Burmese. The following is an extract from his letter in reply :—" I think that I may say that we have no grain-crops in British Burmah in field cultivation except paddy, and the varieties of it can be counted by hundreds." He very obligingly sent a small supply of paddy of two or three of the varieties most highly esteemed. These reached Madras in good condition, and were cultivated in the way usually adopted with ordinary paddy. Though in each case a full average crop of straw was produced, the yield of grain was very light, many of the ears being quite without grain. Had these crops been sown before the full burst of the north-east monsoon, the results might have been more favorable. It is, I think, probable that these kinds of paddy would thrive better in Malabar and on the western side of the Presidency than here on the Carnatic side, where the air is generally very dry. As these varieties of Burmese paddy produce a rice that commands in the local market a much higher price than the rice of the kinds of paddy usually grown in Madras, they are well worth the attention of cultivators who reside where a favorable climate is found.

112. *Mauritius.*—Small supplies of lentils and maize were received from Mauritius in response to an application for field-seeds. The lentils are highly esteemed in Mauritius, but unfortunately they did not thrive on the Experimental Farm, where they were sown. The seed was fresh and germinated well, but the plants never exceeded six inches in height ; they flowered, but yielded no pulse. The experiment should be repeated ; it is very desirable that something should be done towards introducing a good pulse crop into this part of India. The maize grew admirably and yielded very heavily ; from 125 pounds that were sown on the Experimental Farm 5,000 pounds of clean seed were obtained.

Oil Cake.

113. *Ground-nut Oil Cake.*—I mentioned in my last annual report that the price of this oil cake had risen more than 50 per cent. in Madras and in the districts around since I first directed attention to its qualities, and that I was, therefore, obliged to seek for supplies for the Sydapet Farms in localities, where the qualities of the cake had not yet become generally appreciated. I also mentioned that I had succeeded in making a contract in Mysore for 10,000 pounds monthly at Rupees 6-12-0 per candy of 500 pounds. Unfortunately, of the first supply, 20,000

pounds, received under this contract, I was obliged to reject 8,000 pounds, as the cake, instead of being made entirely of ground-nuts, contained a considerable quantity of the crushed seeds of a purgative oil seed ; indeed, the whole of the cake received was impure, but in the cake retained there was a much less quantity of the impurity ; but, small as this was, our stock suffered severely after eating the cake. I ascertained, on making inquiries, that it is almost the universal custom in Mysore to crush with ground-nuts two or three other kinds of oil seeds, under the impression that the mixed oil is more valuable than the pure oil of the ground-nuts ; and, as the oil seeds, that are added are more or less purgative in their action when eaten, it is easy to understand why the cake should prove hurtful to stock fed on it. As the contractors stated that it was quite impossible for them to obtain pure ground-nut oil cake in Mysore, I was obliged to cancel their contract.

114. After some trouble I found a contractor willing to supply pure cake from Vellore on the terms on which the Mysore cake was to be supplied. I have now received regularly 10,000 pounds of the Vellore cake monthly, and have had every reason to be satisfied with its general quality.

115. I have referred to these matters as, during the past year, I have had a good deal of correspondence with gentlemen in different parts of the Presidency who have tried the cake in their stables and byres on my recommendation, and in several instances have obtained results the reverse of satisfactory. In the Tanjore District a gentleman, who attempted to feed his horses and cattle on ground-nut oil cake, found that the cake was eaten most reluctantly by all the animals, and that, after continuing in its use for some time, the animals gradually lost flesh. I obtained a sample of the cake used, and found it to be perfectly pure ground-nut oil cake, but it was thoroughly saturated with oil from imperfect extraction ; though the oil has a sweet, agreeable taste when fresh, it is when rancid exceedingly disagreeable, and as this rancidity is developed during the time the cake is being steeped for use, it is easy to understand why the cake was so disliked by the stock, and the presence of the oil in such large quantities would render the cake slightly purgative. It was only necessary that the oil should have been more thoroughly extracted to have made the cake a really first-class food for stock. Correspondents resident in Mysore have complained that ground-nut cake, when given to young horses, affects the action of their kidneys to an injurious extent, but the results, already noticed, of my experience with Mysore cake sufficiently explain why this is so. To one gentleman who made this complaint I forwarded a sample of pure Vellore cake with a request that he would compare it in a certain way with a sample of the cake he had been giving to his horses. The result of this comparison is given in the following extract from his reply :—" I have tried the ground-nut-cake as you suggested and find it as you say. After emersion for twenty hours, the Bangalore cake is sticky and lumpy, is generally coarse, and has an unpleasant taste, while the Vellore cake which you sent me is much whiter in color, is without hard lumps in it, and is sweet to the taste." I would add to the foregoing that, in my experiments, in comparing a sample of Bangalore ground-nut cake with a sample of the same kind of cake procured from Vellore, the pieces of the former cake when put into water formed only a layer at the bottom of the glass, while the same quantity of the pieces of Vellore cake formed, after emersion for a similar time, a rich mucilaginous jelly, which rose up and entirely filled the glass.

116. From the many inquiries that have reached me regarding this valuable cake, I am led to believe that it is but little known to Europeans even in localities where it can be obtained in abundance at a low price ; the following remarks may, therefore be of use. The cake is the refuse obtained in the manufacture of ground-nut oil. The nuts are produced in the underground pods of the *corachis hypogœa*, a plant that is grown very largely in many parts of this Presidency as an ordinary field-crop. The Tamil name of the plant is Varcadalay, its Telugoo name is Varchenegaloo, and its Hindustani name is Velayethe Moongka pulli. The plant belongs to the natural order *Leguminosœ* ; its pods, as before noticed, bury themselves in the soil.

117. The oil of the ground-nut is highly valued in Europe ; indeed, it is generally quoted at a price from 10 to 15 per cent. higher than the best linseed oil ; it is said to be largely used as a substitute for olive oil, and that it is chiefly used for preserving sardines.

Draining.

118. *Subsoil Draining.*—In my last annual report I referred to an experiment in subsoil draining which had been begun but a short time before the close of the year. The field selected for the experiment measured nearly four acres ; it is divided in two nearly equal-sized parts by an open channel. One of these portions, which I shall refer to as plot (*a*), measures 8,800 square yards ; the other portion, plot (*b*), measures 8,742 square yards. The whole of the field has been drained in one way under what is known as the "gridiron" system. The ordinary drains are 3½ feet deep, and are placed 24 feet apart. Each plot is provided with one main drain which runs along at right angles to the line of the parallel drains, and into which the whole of the water is discharged ; the outlet of this drain is formed of brick built in lime with an iron grate over the vent to prevent rats, &c., going up the pipes. The depth of the main drain is four feet. Stone-drains have been laid down over the whole of plot (*a*), while plot (*b*) has been drained by means of pipe-drains.

The following statement shows the cost incurred in draining plot (*a*) :—

——	Cost.			Cost per acre.		
	Rs.	A.	P.	Rs.	A.	P.
Cost of cutting paralled drains, 988 running yards, at 3½ Rupees per 200 running yards	17	4	8	9	8	2
Cost of cutting main drains, 97 running yards, building an outlet, and providing a grate	6	14	7	3	12	10
Cost of broken stones, 341 parahs, at 4 pies per parah, 1,658 parahs, at 3¼ pies per parah	35	2	8	19	5	6
Cart-hire for carting broken stones from quarry, 66 days, at As. 12	49	8	0	27	3	7
Cost of placing the broken stones in the drains, filling drains, &c.— 25 men at 3 Annas per day and 45 women at 2 Annas per day ...	10	5	0	5	10	9
Total...	119	2	11	65	8	10

119. The cost per acre is very high, and is considerably in excess of the cost estimated in my last report. There are two reasons why this was so ; first, the coolies, not being able to use ordinary draining tools, it was found necessary to dig the drains very much wider than was originally intended in order to admit of them using their short-handled tools in the drains. This additional width caused no increase in the cost of cutting the drains, but it caused a very serious increase in the cost of the work by the necessity it created for the employment of a much larger quantity of broken stones than would have been required had the drains been cut only the usual width ; the other cause of the increased cost was the mismanagement of the carting, which, instead of being done under contract, was done by day-labor, and was not properly overlooked ; but, for these two causes, the cost of the work would not, I feel certain, have exceeded the estimate I gave : however in an experiment of such a very novel character it was not surprising that everything did not work as smoothly as might have been desired.

120. It was found impracticable to make drain-pipes on the farm in time to allow of the experiment being begun last year, and as drain-pipes could not be procured anywhere in the Presidency, I had no alternative but to use sewage-pipes, which are, of course, far too expensive, as for use in field draining these pipes are but little, if at all, superior to ordinary drain-pipes ; it would not be fair to debit the experiment with their cost; fortunately I have at hand figures of a reliable character from which the cost of manufacturing two-inch drain-pipes can easily be ascer-

tained. Since this experiment in draining was begun, we have had a considerable amount of experience on the Experimental Farms in the manufacture of two-inch drain-pipes, and this experience has afforded the following :—For an expenditure of Rupees 62 on labor and cattle-hire, 16,000 two-inch drain pipes were made and dried ready for burning, the average cost per thousand being Rupees 3-14-0 : this may be divided as follows :—

	RS.	A.	P.
Raising and mixing clay	0	6	0
Screening, &c.	0	10	0
Making pipes, rolling, &c.	2	2	0
Turning and drying pipes	0	4	0
Cart-hire	0	6	0
Other work...	0	2	0
Total...	3	14	0

As was to be expected our first attempts in burning the pipes were not attended with complete success. The kiln was but newly erected, the men were untrained, and the result was that a large quantity of the pipes was spoiled in burning. I cannot, therefore, from these results calculate the cost of the fuel used in burning the pipes. I prefer to take the cost from the results obtained during a considerable experience in pipe-burning at Home. In England with ordinary kilns it is found that 2¼ tons of coals are quite sufficient for burning 12,000 two-inch pipes; these at the Madras price, Rupees 24 per ton for coals sufficiently good for pipe-burning, would represent Rs. 4½ per thousand, but pipes do not need an intense heat; casuarina wood might be used either in part or exclusively as the fuel, in which case the cost of fuel for each thousand two-inch pipes would not exeeed Rupees 4 ; a further charge of Rupees 1¼ per thousand will pay the labor at the kiln and provide a fair allowance for interest on capital employed, wear and tear of sheds, machinery, &c., making a total charge, amounting to Rupees 9-2-0 per thousand, for well-burned two-inch pipes, which is the price charged in the following statement. The price of the pipes used in the main drains is obtained in the same way. With these exceptions, the items in the following statement are the actual charges incurred in draining plot (*b*) as follows :—

—	Cost.			Cost per Acre.		
	RS.	A.	P.	RS.	A.	P.
Cost of cutting parallel drains, 1,088 running yards, at Rupees 3-8-0 per 200 running yards	19	0	8	10	8	8
Cost of cutting 95 running yards of main drain, building outlet, and providing a grate	6	13	11	3	12	10
Value of 3,264 two-inch drain-pipes estimated at Rupees 9-2-0 per thousand	29	12	7	16	7	10
Value of 285 four-inch drain-pipes estimated at Rs. 12 per thousand.	3	6	9	1	14	4
Cart-hire for conveying pipes from kiln to field	3	0	0	1	10	7
Cost of laying pipes and filling earth into the drains—29 men at 3 Annas and 53 women at 2 Annas	12	1	0	6	10	10
Total...	74	2	11	41	1	1

121. With further experience it will, I think, be found possible to reduce the cost of draining an acre of land with pipes in the way described to Rupees 35, which sum charged over twenty-five years at the rate of $7\frac{1}{10}$ per cent. per annum, which would repay the whole of the capital with interest at 5 per cent., would represent an annual charge, amounting to Rupees 2-7-8 per acre, a very moderate price to pay for the benefits that will be gained. By increasing the depth of the drains and by placing them at wider intervals over the land, the cost of draining could be further reduced ; but, before this could be done, we must train our laborers to work with ordinary drain tools made, in size and weight, to suit their strength.

122. Of course, the fact that we have in this country to deal with conditions widely different to those met with in Europe must not be lost sight of; it is quite possible that the European system may prove unsuited to encounter the peculiar difficulties that may be met with in India. There is not room for a single doubt regarding the benefits the country will gain from its retentive soils being subsoil drained, but a difficulty may be experienced in devising a system of drainage specially suited to meet difficulties which may be encountered, such, for instance, as the closing of the pipes by white ants; the effects of a sudden fall of say 5 inches of rain in 24 hours, after an interval of say three months, in which not a drop of rain fell, &c.

123. Both of the plots were under maize and cotton last season; the crops were very good, seeing that, before being drained, the land was perfectly useless. Elsewhere will be found full particulars regarding these crops.

124. Plot (*a*) has not been successfully drained; the discharge of water after heavy rain was never very great, but lately it has been exceedingly small; there is evidently a stoppage somewhere. I fear that the openings in the soil which appeared in all parts of the field during the long drought, admitted the fine surface-dust amongst the stones during heavy rains; this dust forms on the surface of our arable soils during a drought, and from its extreme fineness it is easily conveyed away by water. Of course, when the water filters down through the soil, as it should do, this dust can never reach the drains; but the deep fissures I have before alluded to afford it a free passage. As long as the drains work properly, this would do but little injury; but immediately a stoppage occurs, it forms a dense mass with the broken stones that form the drain, and most effectually stop the passage of water. In Europe it has been found that thorough subsoil drainage at once puts an end to this periodical cracking of the soil, and it may prove to be so in this country when the drains have been longer in operation; but so far they have not proved effectual in this direction. By frequently cultivating and stirring the soil we can do a great deal to prevent the appearance of these fissures, but the system of drainage to be adopted in this country must be more perfect than to depend for success on the surface-soil being kept thoroughly tilled. Further experiments in draining with broken stones must be made before any conclusion can be formed. Though in the experiment I have made the cost of draining with stones is exceedingly high, it must not be forgotten that the whole of the expenditure incurred was for labor, and that while many ryots have not the means with which to purchase drain pipes, they can in most cases afford the labor needed for draining with stones.

125. The drainage of plot (*b*) has been most successful. The discharge of water is very great after heavy rains; during the monsoon, the flow for several days was as great as the pipe could discharge, and I have every reason to believe that up to the present time the action of the pipes continues quite perfect.

126. As far as can be judged from the short time these drainage experiments have been in operation, I consider that pipes will be far better suited than stones for use in draining, in this country. An important advantage attending the use of pipes is that land so drained can, during a drought, readily be subsoil irrigated by passing the irrigation water into them, sluices being put in the drains at suitable places to prevent the water passing out. By subsoil irrigation the water can be far more evenly distributed; no surface ground is required for water channels and there is less waste by evaporation. By thus combining drainage with irrigation, the agriculturist will be less dependent on the character of the seasons than at present.

Implements, Machines, &c.

127.—*The Double Mhote.*—Though the general results noticed in detail in my last report obtained in our experiments with this water-lift were most satisfactory, I thought that we might effect a still further improvement by substituting zinc buckets for the iron buckets with leather discharging tubes usually employed, and which so frequently needed repair; and the Overseer of the Experimental Farm having directed my attention to a model of a water-lift that he had con-

structed, in which zinc buckets were used on guide-rods that appeared to work in a satisfactory way, I determined to erect a double mhote at a well where a water-lift was needed, and to provide it with zinc buckets on the arrangements shown in the model, the fixed part of the machine was similar in construction to that of the double mhote noticed in my last report, excepting that only one horizontal beam resting on two pillars, with a short beam also resting on a pillar, were used instead of two long beams and four pillars, thus effecting a small saving in the cost of the machine. The buckets used were made of sheet zinc, strengthened by a light framework of iron ; on this framework, on either side, at about half the height, were placed iron rings which worked on the guides ; the bottoms of these buckets were perforated, and these holes were covered by a leather valve, which opened as the buckets began to descend into the water, and closed immediately they began to ascend ; the ropes were attached to handles made of rod iron, bent over on each side of the bucket and fixed on pivots, each bucket measured 2 feet 6 inches in height and 5 feet inches in circumference and brought to the surface on the average 36 gallons of water at each ascent. Each bucket worked on a pair of guide-rods made of round iron ; the lower ends of these rods were fixed in stones sunk in the bed of the well, their upper ends being fixed in the masonry of the discharging cistern, the rods were quite perpendicular from the bottom of the well up to the surface of the ground, when they gradually began to curve towards the cistern ; by this arrangement the buckets were made to empty their contents. At first it was found that the rods used were far too slight ; they vibrated so much during the ascent of the buckets, sometimes to such an extent as to arrest their progress, causing a severe strain on the working parts of the machine, this gradually became worse, until at length we had no choice but to remove the light rods and replace them by rods of a much greater diameter. When worked steadily, the machine gave most satisfactory results, raising in a day at least 50 per cent. more water than the first double mhote we erected, but the heavy rods though $\frac{3}{4}$ inch in diameter still vibrated very severely whenever the speed of the bullock was irregular. The machine was so severely strained whenever the buckets were checked in their ascent, frequent repairs became necessary, and as these were exceedingly troublesome in delaying work, and as I could see no way of rendering the rods more rigid, unless I incurred a considerable expense, I was obliged most reluctantly to abandon this arrangement for raising water, and to go back to the method described in my last report. If it had been possible to secure a steady working power, the arrangement would have answered admirably, but the slightest neglect on the part of the driver frequently caused an entire stoppage of the machinery. Had the water been nearer the surface of the ground, the vibrations in the rods would not, I think, have caused any inconvenience ; in the case noticed the water had to be raised 20 feet. If the rods could be stayed from the sides of the well they could be rendered quite rigid, but in this case the guide-rings could not be used, it would of course be possible, instead of the rings, to use a horse-shoe guide, which would not be arrested in passing up or down by the stays, but even with this it would be necessary to drive the cattle with great care or the guides would be thrown off the rods.

128. *Bullock-Gears.*—The bullock-gears in use for driving the water-elevators on the Experimental Farm have been considerably improved during the past year ; this improvement is in the method of attaching the cattle. Under the old arrangement, the two bullocks employed in working the elevator were separately yoked at opposite ends of a long pole, which was placed horizontally over the parapet wall across the centre of the well, and was supported and fixed in the middle to a head resting on the upright shaft of the driving wheel ; this pole projected about 4 feet on either side of the well, the ends being about 2 feet higher than the level of the bullock path, to these ends swingle-trees were attached, to which the bullocks were yoked by means of chains, connected with their collars. When engaged in raising water the cattle travelled around the well, and as there was always the well between them, it was exceedingly difficult to keep them going at a regular pace, when only one driver was employed ; when the driver was behind one bullock, the one on the other side took its ease, and when it received the attention of the driver the other in its turn slackened its pace, thus an irregular jerky motion was produced in the water-lift,

causing much injury to the working parts, and lessening the amount of work performed. A seat was placed for the driver over the centre of the well on the horizontal pole which rotated as the animals travelled around, but this seat was much disliked by the driver, and I think not without good reason, while when so seated he was not more successful than when on foot; the fact is the cattle of this country are trained to work with their driver behind them, and it is exceedingly difficult to get them to work in any other way. Under these circumstances I determined to try what could be done to admit of the driver being always near both bullocks, as it would have been much too costly to employ two men. The head for the straight shaft was removed and in its place a V-shaped head was used, its narrow end was turned inwards and rested on the upright spindle of the driving wheel, in each of the arms of the head an horizontal shaft was fixed, these projected over the bullock path, the distance between these shafts at their outer ends was about seven feet; upright bullock yokes were attached to these shafts, under which the cattle walked, the height of the bullock path having been cut down sufficiently low to admit of this being done, a syphon placed under the path serving to keep up the height of the water discharged by the lift. By this arrangement one bullock walks close behind the other, both being under the control of the driver, thus a larger amount of work is performed and the machinery is worked steadily.

129. *Straw-Burning Engines.*—The improvements recently made in steam engines, whereby they are enabled to burn such fuel as straw, indigo stalks, the stems and branches of cotton plants, &c., will admit of steam being used as a motive power in this Presidency to a much larger extent than seemed possible only a couple of years ago. The districts in which only steam culture seemed pracaticble were almost quite without fuel suited for raising steam in Portable Engines, but, in these districts, after the cotton harvest, there is in the cotton plants a plentiful supply of fuel suited for the requirements of Straw-Burning Engines. Straw cannot be used alone for raising steam in ordinary engines, its combustion is so irregular. We cannot, in Southern India, afford to burn any straw that is fitted for the use of live stock; but there is in most parts of the Presidency a plentiful supply of materials, the refuse of the crops, suitable for use in these engines, that possess no value as food for stock.

SYDAPET MODEL FARM.

130. *The Sydapet Model Farm.*—Before reviewing the results obtained from the working of this farm during the past year, I would, in order that the the nature and present condition of the experiment may be fairly understood, direct attention to the following extracts from my report for the year ending 31st of March 1871, showing the circumstances under which the farm was started:—

"238. The northern portion of the estate which, since the Committee (since abolished) took charge of the property, has always been rented by small tenants, was, in the early part of July last, set apart for the purposes of a Model Farm."

"239. The condition of the land was very unsatisfactory; the greater portion was overgrown with weeds and bushes, and a very considerable area had been appropriated by the public. Not only was the appearance of the land very discreditable; but, owing to the great amount of trespass it caused, it was a nuisance to the neighbouring Experimental Farm."

"240. At no time had the rents been regularly paid; but it had become very difficult to collect even a very small proportion. It was in vain that large remissions had been made; the renters were men of very small means, and several were without any agricultural training."

"241. Most of them held under a five-years' lease, two years of which were unexpired. During the early part of last year several of them petitioned to be allowed to relinquish their land: but it was not until the month of July, when a general petition was received from all the tenants, that, seeing no other chance of bettering matters, it was determined to write off all arrears, and to take the land into our own management.

"253. Attempts have evidently been made, at different times, to bring portions under cultivation; many of these attempts had been made in injudiciously-selected places, the result

was a broken surface on which it was scarcely possible to find a block of five acres fit for immediate cultivation..... "

"242. The total area thus set apart for a Model Farm is 115 acres; of this area seven acres is occupied by the nullah, roads, buildings, &c....."

"243. Nearly thirty acres can be irrigated, twenty acres from the Mambalam tank by gravitation and the remainder from the wells by picottahs, &c....."

"244. The dry soils differ greatly; about thirty acres is a blowing sand of the lowest type, about forty acres is a sandy loam of fair quality, free and easy to work, but in a very impoverished state; the remainder is a stiffish loam with a good deal of clay in its composition and a considerable amount of the red oxide of iron."

"245. To put the undertaking on a thoroughly commercial footing, it was determined to fix the rent at the average yearly income of the previous four years, and to deduct the annual value of the fruit trees which had to be removed to facilitate the work of reclamation."

"246. The average income of these four years was found to be Rupees 535."

"9. It was necessary, in order that the land should be thoroughly reclaimed and put into a good cultivatable condition, that a large number of indifferent mango and guava trees should be cut down. These were chiefly old trees which would not continue to bear much longer, though for a season or two they would be worth 150 Rupees per annum. Deducting this sum from the average annual income from the land, there remains a balance of 385 Rupees, and this sum will be the yearly rent to be recovered from the Model Farm. The timber and jungle clearings realized 2,721 Rupees; this was carried to the credit of the estate....."

131. It will be gathered from these extracts that the rent of the land selected for this Farm was fixed without any regard to the condition of the land or the quality of the soils. The fact that it had been abandoned by the persons who had previously rented it did not receive sufficient attention at the time the rent was fixed. It seemed perfectly fair to adopt as the rent to be paid by the Farm the average annual income derived from the land during the previous four years, but a sufficient allowance should have been made to compensate for the broken surface of the land, and for the worn-out and exhausted state of the soils.

132. Up to the present time the sum expended in bringing this land into cultivation is about Rupees 2,300, and it is probable that before the whole of the land is brought into a good cultivatable condition the entire expenditure will reach something near 5,000 Rupees. From its commencement, besides paying a full rent, the Farm has been debited with a charge at the rate of 7½ per cent. on every Rupee expended on works of reclamation and improvement, the sums paid on this account being as follows :—

	Rs.	A.	P.
1870-71	94	6	7
1871-72	296	1	8
1872-73	328	1	6
1873-74	328	1	6
Total...	1,046	11	3

But this also includes interest on the capital expended in erecting buildings, which amounts to about Rupees 2,000; this, at 7½ per cent. for 3½ years, represents Rupees 525, which sum taken from Rupees 1,046-11-3 leaves Rupees 521-11-3 as the sum paid in the shape of interest on the money expended in reclaiming the land from its dilapidated condition &c. It seems to me now, scarcely fair to have called upon the Farm to pay this amount in addition to the full rent, for the rent charged *but just represents the value of the land after reclamation.* In proof of this I quote below an extract from the Classification Register of the southern portion of the estate, which land was taken up to form the Experimental Farm, and which, at the time it was classified and valued, was almost as well suited for being immediately brought under regular cultivation as

is the Model Farm land, after so much money has been expended in reducing its surface to a state fit for being brought under regular cultivation.

Classification Register of that part of the Model Farm (Experimental Farm) that as been already laid out in fields.

No.	Irrigated or dry.	Source of irrigation.	Description of soil.	Taram.	Rate per acre.	Area.	Assessment
					RS. A.	ACRES. CENTS.	RS. A.
1*a*.	Dry	Government well.	Permanently improved...2 1	1	4 8	0 25	1 2
...*b*.	Do.	.....	Black sand...5 1	5	1 8	4 21	6 5
2	Do.	.....	Do. ...5 2	6	1 4	15 51	19 6
3	Do.	.....	Red loam ...7 2	5	1 8	6 66	10 0
4	Do.	.....	Do. ...7 2	5	1 8	1 94	2 15
5	Peramboke...	.....	.....	...	.....	0 67	.....
6	Dry	Government well.	Permanently improved...2 1	1	4 8	0 68	3 1
7	Do.	.....	Black loam...4 2	4	2 0	0 75	1 8
8	Do.	Government well.	Red loam ...7 1	4	2 0	8 63	17 4
9	Do.	.....	Do. ...7 1	4	2 0	5 21	10 7
10	Peramboke...	.....	.....	...	.....	5 18	.....
11	Dry	Government well.	Permanently improved...2 1	1	4 8	3 90	17 9
12	Do.	.....	Red loam ...7 1	4	2 0	4 11	8 4
13	Do.	.....	Do. ...7 1	4	2 0	3 93	7 14
14	Do.	.....	Black sand...5 2	6	1 4	3 99	5 0
15	Do.	.....	Do. ...5 2	6	1 4	11 96	14 15
16	Do.	.....	Black loam...4 2	4	2 0	5 59	11 3
17	Do.	.....	Do. ...4 2	4	2 0	4 43	8 14
18	Do.	.....	Black sand...5 2	6	1 4	7 19	9 0
19	Do.	.....	Do. ...5 2	6	1 4	12 14	15 3
20	Do.	.....	Red sand ...8 2	6	1 4	2 61	3 4
21	Do.	.....	Do. ...8 2	6	1 4	1 47	1 13
22	Do.	.....	Do. ...8 2	6	1 4	3 34	4 3
23	Do.	Government well.	Do. ...8 2	6	1 4	5 1	6 4
24	Do.	.....	Do. ...8 2	6	.....	3 79	4 12
25	Peramboke...	.....	.....	...	.....	9 42	.....
					Total...	132 57	190 2

Abstract exhibiting the area and assessment of each class of soil

Taram or class.	Rate per acre.	Area.	Assessment.
	RS. AS.	ACRES. CENTS.	RS. AS.
1	4 8	4 83	21 12
4	2 0	32 65	65 6
5	1 8	12 81	19 4
6	1 4	67 1	83 12
Total...		117 30	190 2
Peramboke...		15 27	.....
Grand total...		132 57	.....

(Signed) R. K. PUCKLE,
Deputy Director, Revenue Settlement.

(133.) After the completion of the improvements now in progress, the soils of this Farm may be roughly classified and valued as below:—

				Annual rent. Rs.	A.	P.
20 Acres under tank* irrigation	at Rupees	10	per acre ...	200	0	0
10 Acres under well irrigation	at ,,	5	per acre ...	50	0	0
40 Acres of dry land	at ,,	2	per acre ...	80	0	0
30 Acres of dry land	at ,,	1½	per acre ...	37	8	0
8 Acres of dry land	at ,,	3	per acre ...	24	0	0
7 Acres under roads, &c.				...	...	..
111				391	8	0

134. But before the land is brought into this condition, the total expenditure incurred, as before noticed, will not be less than Rupees 5,000, which sum, at 7½ per cent., will represent an annual charge of Rupees 375 in addition to the rent, making the gross rental Rupees 760, or about *twice the amount at which the rent would have been fixed by the Settlement Department;* and in addition to this the farm pays 7½ per cent. on capital invested in buildings, and 5 per cent. on its working capital; the last two items are fair, but I certainly think that the farm *should be relieved of all charges on behalf of expenditure in levelling the land, &c.*, as these improvements directly add to the value of the property, and should not in justice be made at the expense of the occupying tenant.

135. On first starting the Model Farm, being so anxious that it should be debited with every charge that could in reason be placed against it, I unfortunately went too far in this direction, and burdened the farm with charges which, I am now convinced, should not have been debited against it. Thus, while the farm has been struggling with difficulties and showing an unsatisfactory balance sheet from having to meet these charges, the value of the property has been gradually increasing. In short, the tenant has been sacrificed for the good of the landlord. For if the estate was put into the market to-morrow, it would bring at the least Rs. 5,000 in excess of the price paid for it, and when the farm was begun timber and clearings to the value of Rupees 2,700 were sold, and the proceeds paid over to the landlord.

136. At the close of the year under review there was a debit against the farm amounting to Rupees 1,674-0-9, that is, after paying the full rent interest at 7½ per cent. on capital sunk in permanent improvements, interest at 5 per cent. on working capital, and every other charge since the farm was begun; the result of last year's operations is as follows :—

The expenditure—	Rs.	A.	P.
Rent and interest	913	1	6
Overseer's salary	610	0	0
Labor	1,317	1	11
Cattle	105	0	0
Pigs	67	0	0
Sheep	35	8	3
Poultry, rabbits, &c.	45	2	0
Implements, machines, and tools...	67	5	0
Seeds	122	13	5
Cattle food	531	15	1
Manure	41	7	7
Sundries	16	10	2
	3,873	0	11

Income—			
Advance from General Funds	1,522	13	8
Cattle	419	7	5
Sheep	188	10	9
Pigs	390	11	6
Poultry, rabbits, &c.	65	2	10
Fruits, plantain, and vegetables	290	1	11
Fodder, &c.	238	11	3
Grains	411	5	7
Indigo and cotton	232	12	6
Sundries	113	3	6
	3,873	0	11

* During 5 months only in the year.

The balance sheet on the 31st March 1874.

Liabilities.				Rs. A. P.
Loan from General Funds for 1870-71				2,776 9 10
Do. do. for 1871-72				1,310 3 11
Do. do. for 1872-73				1,772 2 2
Do. do. for 1873-74				1,522 13 8
Laborers' pay due for March 1874				155 5 3
		Total Liabilities...		7,537 2 10
Assets.				
Cattle.		Rs.	A. P.	
16 Working cattle		1,200	0 0	
5 Feeding cattle		75	0 0	
Sheep.				
26 Ewes, 4 Wethers, 23 Lambs		260	0 0	
Pigs.				
5 Boars, 7 Sows, 4 Geldings		450	0 0	
Poultry		75	0 0	
				2,060 0 0
Implements.				
Implements, tools, carts, &c., as catalogued ...		...	... ...	760 1 6
Manures.				
200 Cart-loads of alluvial earth		30	0 0	
130 Do. of fold-yard manure		97	0 0	
43 Cart-loads of sulphate of lime and ashes ...		10	0 0	
¼ Cost of manure purchased in 1872-73... ...		30	3 7	
¼ Cost of cake purchased in 1872-73		126	8 11	
½ Cost of manure purchased in 1873-74... ...		20	11 9	
½ Cost of cake purchased in 1873-74... ...		265	15 6	
4,500 Pounds of straw		20	0 0	
				600 7 9
Fruit Trees, &c.				
Cocoanut and Mango trees, Casuarina trees, Guava trees		762	0 0	
Fruit Crops.				
Gauva, &c.		350	0 0	
				1,112 0 0
Field Crops.				
Grain and pulse crops...		80	0 0	
Guinea grass		150	0 0	
Fodder crops of sorts		250	0 0	
				480 0 0
Cattle Food.				
338 Pounds of oil cake		5	0 0	
15,000 Pounds of cholum straw		70	0 0	
Seeds, &c., in Granary.				
1,242 Pounds of car paddy		20	11 2	
874 Do. of sumba paddy		17	7 8	
25 Do. of indigo seed		2	0 0	
20 Do. of yellow cholum		0	8 0	
Sundries		199	8 0	
Cultivation done for next season's crop ...		100	0 0	
Uncollected bills		435	6 0	
				850 8 10
Deficiency		...	... ...	1,674 0 9
				7,537 2 10

137. The return obtained from most of the best land was greatly lessened by the bad physical condition of the soil, produced by the flooding of the river Adyar; not only were several successive sowings destroyed, but the land from the absence of drainage became water-logged and yielded little more than half a crop. I am convinced that, unless this land, subject to being flooded, is thoroughly subsoil drained, it will never return a reasonable profit under high cultivation.

138. Under low farming, when little is spent on manure, &c., &c., there is but little to lose when adverse circumstances are encountered. High farming demands a large expenditure on labor, manure, &c., and the loss is proportionately great when unpropitious conditions are met with; hence before high farming can be successfully practiced, the conditions with which it has to deal must be somewhat under control, and therefore irrigation and drainage are essential to success where floods and droughts occur periodically.

139. Unfortunately the Model Farm is but ill-provided with irrigation water, and it is altogether without drainage of any kind. During the cropping season, between September and the end of November, all the low-lying land is frequently submerged by the overflow of the river which frequently results in the entire destruction of the paddy under which this ground is cropped, rendering it necessary to replant as late as December, which crops are not matured until April, by which time the irrigation water from the Tank has ceased to flow; if we can subsoil drain these low-lying lands, the ill-effects of the floods would be much less serious, as the drains would soon carry off the excess of water, and we would be able to harvest our crops in December, and thus not only be able to secure good crops, but we would have the further advantage of taking a second crop off the land before the irrigation source failed for the season.

140. The following statement shows the income and expenditure of the farm from its commencement:—

Income up to and including 31st of March 1874.

Items.	*1870-71.	1871-72.	1872-73.	1873-74.	Total.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Cattle...	403 1 9	560 14 9	371 15 0	419 7 5	1,755 6 11
Sheep...	... ...	141 10 6	237 2 6	188 10 9	567 7 9
Pigs	... ...	263 14 0	664 5 9	390 11 6	1,318 15 3
Poultry, rabbits, &c....	12 6 0	97 8 0	203 4 0	65 2 10	378 4 10
Fruits, plantains, and vegetables, &c. ...	474 12 6	582 10 3	444 1 6	290 1 11	1,791 10 2
Hay, green fodder, &c.	42 8 0	256 6 0	484 13 6	238 11 3	1,022 6 9
Grains.	407 0 10	705 9 3	178 11 2	411 5 7	1,702 10 10
Indigo and cotton ...	... ...	... ...	... ...	232 12 6	232 12 6
Sundries	101 10 3	228 4 0	301 9 10	113 3 6	744 11 7
Total...	1,441 7 4	2,836 12 9	2,885 15 3	2,350 3 3	9,514 6 7
Add the net valuation of the assets on the 31st of March 1874					5,707 12 10
				Total...	15,222 3 5

* Half year.

Expenditure up to and including 31st of March 1874.

Items.	*1870-71.	1871-72.	1872-73.	1873-74.	——	Total.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Cooly labor	1,105 4 2	1,375 9 11	1,369 14 0	1,317 1 11	5,167 14 0	
Manure	3 0 0	71 1 4	185 2 7	41 7 7	300 11 6	
Live stock	1,641 15 0	731 6 8	636 3 0	252 10 3	3,262 2 11	
Food for live stock	267 11 9	557 7 3	506 3 11	531 15 1	1,863 6 0	
Seeds, trees, &c.	194 1 7	91 6 7	153 9 2	122 13 5	561 14 9	
Implements, tools, &c.	461 9 0	18 13 0	277 8 6	67 5 0	825 3 6	
Contingencies	74 4 9	100 2 3	16 6 9	16 10 2	207 7 11	12,188 12 7
Overseer's salary	113 12 0	370 0 0	600 0 0	610 0 0	1,693 12 0	
Rent	192 8 0	385 0 0	385 0 0	385 0 0	1,347 8 0	
Interest on capital employed in working the Farm.	69 8 4	150 0 0	200 0 0	200 0 0	619 8 4	
Interest on capital expended on improvements of a permanent character	94 6 7	296 1 8	328 1 6	328 1 6	1,046 11 3	4,707 7 7
Total	... ...	... ...	... ...	... ...	... ...	16,896 4 2

141. It will be noticed, from what I have said, that the information to be derived from this experiment is *the cost of reclaiming and restoring land that has been exhausted under native farming*, rather than *the commercial results that can be secured by adopting a better system of agriculture;* to open a farm on virgin land and bring it into cultivation, is widely differen t.

IMPLEMENT WORKSHOPS.

142. During the past year Rupees 2,363-1-8 were received for implements, machines, &c., sold, and for labor and materials supplied by these workshops; and the expenditure on their behalf was Rupees 2,149-7-3.

143. The balance against these workshops from their commencement up to the 31st of March 1874 is Rupees 540-0-4, which sum includes interest on capital and every other charge. There should be no deficiency, as the prices charged are fixed to cover the cost of materials, coals, labor, interest on the capital employed, &c.; but during the past year the prices of iron and coals have fluctuated so greatly it has been difficult to adjust our charges to provide for these fluctuations, and it is exceedingly difficult in a small undertaking such as this is to keep accurate accounts, especially when much repairing work has to be executed; we cannot yet afford to employ a foreman in these workshops who would be able to keep accounts, and we have therefore to make up our charges for work, &c., from the rough memorandum kept by the workmen themselves. The Overseer of the Experimental Farm has charge of the workshops, but he can give them but very little personal attention, as his duties on the farm afford him full employment. A large amount of repairs are done for both farms, and it is very probable that all these charges have not been credited in the workshop account, especially for the work performed during the three months that Overseer Young was engaged in connection with the Agricultural Exhibition.

144. The debit against these workshops at the close of the year is but an insignificant sum, in comparison with the sum that would represent the advantages the Sydapet Farms enjoy from these workshops.

145. The recent appointment of an Assistant to aid me will enable me to put the accounts on a better footing, and make the workshops generally more efficient.

146. These workshops supplied during the year three improved carts, nine iron and combined ploughs, one iron cultivator, two sets of iron harrows, forty-two improved grass knives, several working models of ploughs, water-lifts, &c., a number of tools, and did a large amount of work for the Sydapet Farms.

* Half year.

147. The following are the details of income and expenditure during the past year :—

Income.

	Rs.	A.	P.
Machines	834	10	9
Materials, labor&c., ...	1,528	6	11
	2,363	1	8

Expenditure.

Plant	4	5	0
Cooly labor, &c.	1,158	2	10
Materials, &c....	986	15	5
	2,149	7	3

Implement Workshops balance sheet for the year ending 31st of March 1874.

Liabilities.

	Rs.	A.	P.
Advance from General Funds for 1870-71	883	1	5
Do. do. for 1871-72	213	1	2
Do. do. for 1872-73	1,077	3	2
Laborers' pay due for March 1874	88	13	3
Outstanding bills	95	0	0
	2,357	3	0
Deduct capital returned by sale of machines, &c., during 1873-74.	213	10	5
	2,143	8	7

Assets.

Buildings...	419	15	3
Plant	314	5	6
Materials...	197	7	1
New implements, machines, &c., in stock	412	4	0
Outstanding bills	259	8	5
*Deficiency	540	0	4
	2,143	8	7

148. *Establishment.*—The work of this Department having far outgrown the capabilities of any one person, two Assistant Superintendents have been appointed; one is a German and the other is an Englishman; the former, Mr. Kaspar Schiffmayer, received his agricultural training in the Bavarian High School of Agriculture and at the University of Munich; the latter, Mr. Charles Benson, is a graduate of the Royal Agricultural College, England. Both of these gentlemen have arrived in Madras and have entered upon their duties; however, they must have a few months experience in this country before their services can be fully utilized. The general conduct of the Overseers and Clerks was satisfactory; the Apprentices with one or two exceptions conducted themselves in a satisfactory manner.

SYDAPET, (Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
31*st March* 1875. *Superintendent of Government Farms.*

* Since the commencement of the Workshops.

APPENDICES.

Rain-fall registered at the Experimental Farm during the year ending 31st March 1874.

April 1873.	May 1873.	June 1873.	July 1873.	August 1873.	September 1873.	October 1873.	November 1873.	December 1873.	January 1874.	February 1874.	March 1874.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1	1	1 ... 0·14	1	1 ... 0·95	1	1	1 ... 6·15	1	1	1 ... ...
2	2	2	2 ... 0·35	2 ... 0·07	2	2 ... 0·05	2	2 ... 2·31	2	2	2 ... ...
3 ... 0·53	3	3 ... 0·12	3 ... 0·07	3	3 ... 0·23	3 ... 1·10	3	3 ... 1·86	3	3	3 ... ...
4 ... 1·67	4	4	4	4 ... 0·46	4	4 ... 1·28	4	4 ... 0·08	4	4	4 ... ...
5	5	5	5	5	5	5 ... 0·81	5	5	5	5	5 ... ...
6	6	6	6	6	6	6 ... 0·80	6	6	6	6	6 ... ...
7	7	7	7	7	7	7 ... 0·06	7	7	7	7	7 ... ...
8	8	8	8	8	8	8	8	8	8	8	8 ... ...
9	9	9 ... 0·36	9	9	9	9 ... 1·40	9	9	9	9	9 ... ...
10 ... 0·18	10	10	10	10	10	10 ... 0·68	10	10	10	10	10 ... ...
11	11	11	11	11	11	11 ... 0·03	11	11	11	11	11 ... ...
12	12	12 ... 0·20	12	12	12	12 ... 1·03	12 ... 0·52	12	12	12	12 ... ...
13	13	13	13	13	13	13 ... 1·02	13 ... 0·20	13	13	13	13 ... ...
14	14	14	14 ... 0·04	14	14	14 ... 0·56	14 ... 0·93	14	14	14	14 ... ...
15	15	15	15	15	15	15 ... 0·60	15 ... 0·08	15	15	15	15 ... ...
16	16	16 ... 0·46	16 ... 0·10	16	16	16	16	16	16	16	16 ... ...
17	17	17	17 ... 0·05	17	17	17	17 ... 0·51	17	17	17	17 ... ...
18	18	18	18	18	18 ... 1·25	18 ... 0·22	18	18 ... 0·50	18	18	18 ... ...
19	19	19	19	19 ... 0·19	19	19	19	19	19	19	19 ... ...
20	20	20 ... 0·17	20	20	20 ... 0·35	20 ... 0·17	20	20	20	20	20 ... ...
21	21	21	21	21	21	21	21 ... 0·85	21	21	21	21 ... ...
22	22	22	22	22 ... 0·55	22 ... 0·90	22	22 ... 1·60	22	22	22	22 ... ...
23	23	23	23 ... 0·46	23 ... 0·30	23 ... 3·34	23 ... 1·14	23 ... 0·35	23	23	23	23 ... ...
24	24	24	24 ... 0·14	24	24	24	24	24	24	24	24 ... ...
25	25	25 ... 0·37	25	25 ... 1·42	25	25	25 ... 0·77	25	25	25	25 ... ...
26	26	26	26 ... 0·15	26	26	26	26 ... 0·67	26	26	26	26 ... ...
27	27	27	27	27	27 ... 0·22	27 ... 0·27	27 ... 0·59	27	27	27	27 ... ...
28	28	28	28	28	28	28	28 ... 0·59	28	28	28	28 ... ...
29	29	29	29	29 ... 0·17	29	29	29 ... 0·90	29	29		29 ... ...
30	30	30	30	30	30	30 ... 1·08	30 ... 0·35	30	30		30 ... ...
	31		31	31		31		31	31		31 ... ...
Total ... 2·38	Total. None.	Total ... 1·68	Total ... 1·50	Total ... 3·16	Total ... 7·24	Total ... 12·30	Total ... 8·91	Total ... 10·90	Total ... None.	Total ... None.	Total. None.

Government Farms' Expenditure.

	Rs.	A.	P.	Rs.	A.	P.
I. *General Supervision.*						
Establishment, including Superintendent's horse allowance ...	9,981	11	9			
Travelling allowance	...	...	...			
Contingencies	313	12	6			
				10,295	8	3
II. *Madras Experimental Farm.*						
Establishment	918	13	9			
Labor	3,008	10	6			
Implements and machines	882	12	8			
Live stock	297	2	6			
Seeds	195	9	6			
Food for live stock	1,519	1	0			
Manure	542	15	7			
Despatching seeds...	135	5	8			
Contingencies	229	7	5			
				7,729	14	7
III. *Madras Model Farm.*						
Establishment	610	0	0			
Cooly labor	1,317	1	11			
Manure	41	7	7			
Live stock	252	10	3			
Food for live stock	531	15	1			
Seeds	122	13	5			
Implements, carts, and water-lifts	67	5	0			
Rents and interest	913	1	6			
Contingencies	16	10	2			
				3,873	0	11
IV. *Implement Workshops.*						
Blacksmiths, carpenters, and filer	875	9	1			
Cooly labor	282	9	9			
Implements, machines, and materials	991	4	5			
				2,149	7	3
V. *Educational.*						
District Farm Apprentices...	2,166	3	6			
Sydapet do. do.	1,330	6	9			
Schoolmaster for laborers' children	80	1	6			
Books for library	114	0	2			
House-rent, &c., to Assistant Superintendent	483	8	9			
Contingencies	225	5	5			
				4,399	10	1
VI. *Estate Improvements of a Permanent Character.*						
Repairs to buildings, water channels, &c.	1,712	3	0			
Repairs to roads	484	15	6			
Additions to out-houses of Farm bungalow	459	11	5			
Repairing and deepening wells	298	4	1			
Gate-houses and gates	1,023	10	8			
New roads	1,501	9	0			
Water channels	94	14	0			
Sub-soil and surface drainage	553	11	8			
Trees and planting	34	3	8			
Contingencies	14	12	0			
				6,177	15	6
Agricultural Exhibition net expenditure	...		...	8,890	3	1
			Total ...	43,515	11	2

Government Farms' Receipts.

	Rs.	A.	P.	Rs.	A.	P.
I. *Madras Experimental Farm.*						
Fruits, vegetables, &c.	134	10	6			
Fodder, &c.	114	12	9			
Rent, &c.	1,166	9	0			
Cattle	105	0	0			
Sheep	78	11	2			
Pigs	128	14	6			
Poultry, rabbits, &c.	35	9	0			
Feeding-grains, seeds, and cattle-food	370	9	10			
Cotton, &c.	249	2	0			
Sundries	528	14	11			
				2,912	13	8
II. *Madras Model Farm.*						
Fruits, vegetables, &c.	290	1	11			
Fodder, &c.	238	11	3			
Cattle	419	7	5			
Sheep	188	10	9			
Pigs	390	11	6			
Poultry, rabbits, &c.	65	2	10			
Feeding-grains, seeds, and cattle-food	411	5	7			
Indigo	144	4	0			
Cotton	88	8	6			
Sundries	113	3	6			
				2,350	3	3
III. *Implement Workshops.*						
Machines, &c.	834	10	9			
Labor, materials, &c.	1,528	6	11			
				2,363	1	8
			Total ...	7,626	2	7

Valuation of the Live and Dead Stock of the Experimental Farm on the 31st of March 1874.

	Rs.	A.	P.	Rs.	A.	P.
Cattle—						
3 Bulls 21 Working cattle	1,315	0	0			
Sheep—						
38 Rams 60 Ewes 23 Gimmers 44 Lambs	934	0	0			
Pigs—						
3 Boars 20 Sows 20 Young pigs	705	0	0			
Poultry	70	0	0			
				3,024	0	0
Manures.						
Guano, bones, and charcoal Fold-yard and other manures	...	...	...	385	0	0
Growing Crops.						
Fodder (of sorts)	187	0	0			
Plantains, &c.	400	0	0			
Guinea grass	175	0	0			
Cotton	100	0	0			
Indigo	60	0	0			
Cocoanut and cashewnut trees	150	0	0			
				1,072	0	0

Farm Seeds, &c.

		Rs.	A.	P.	Rs.	A.	P.
595	lbs. of Pegu paddy	19	13	4			
475	„ of Goondoo Sumba paddy	9	8	0			
258	„ of Carolina paddy	8	9	7			
245	„ of Sumba paddy	4	14	5			
22½	„ of Red Pootoo paddy	1	0	0			
21	„ of Burmese paddy	1	0	0			
76½	„ of White Pootoo paddy	3	13	2			
65	„ of Car paddy	1	1	4			
616	„ of Yellow Cholum	15	6	5			
147	„ of Shamay	5	14	4			
62½	„ of Horse-gram	1	9	0			
9	„ of Linseed	1	2	0			
30	„ of Gingelly	1	12	10			
47	„ of Green Gram	2	2	2			
143½	„ of Sorghum Saccharatum	7	2	9			
66	„ of Caromony	3	0	0			
233	„ of Corkapilly seed	11	10	5			
140	„ of Caster-oil seed	4	6	5			
153	„ of Cotton in seed	13	8	0			
30	„ of White Oats	2	0	0			
283	„ of clean Cotton	65	14	8			
6,180	Maize Cobs	62	0	0			
234½	lbs. of Wool	21	15	9			
					269	4	7
	Cattle Food.						
3,519	lbs. of Ground-nut oil cake	...	...	...	47	8	1
	Implements.						
	Implements and tools as catalogued in Inventory*	...	...	...	5,027	5	0
		Total ...			9,825	1	8

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st of April 1874.

1 Set of steam ploughing and cultivating apparatus, tackle, windlass, porters, &c. by Messrs. Fowler and Co.
1 Chaff-cutter and universal mill, with bullock-power by Messrs. Ransomes and Sims.
1 Threshing machine, with a bullock-power, by Emery Brothers.
1 Threshing machine by Dray Taylor and Co.
1 Threshing machine, with bullock gear and carriage, by Ransomes and Sims.
1 Threshing machine, with a bullock gear and carriage, by Garret and Co.
2 Winnowing machines by Garret and Co.
1 Winnowing machine by Dray Taylor and Co.
1 Winnowing machine by Ransomes and Sims.
1 Winnowing machine by Hornsby and Sons.
3 Reaping machines by Samuelson and Co.
1 Drill sowing machine, 8 rows, by Garret and Co.
1 Cylindrical corn screw by Ransomes and Sims.
2 Ploughs by Ames and Co., Boston.
1 Turn-wrest plough and yoke by Ransomes and Sims.
1 Stone roller.
2 Drill sowing machines, 13 rows, by Garret and Co.
1 Wood drag-harrow by Experimental Farm.
2 Iron chain harrows.
1 Combined grubber.
4 Bullock hoes.
1 Bullock plough by Howard and Co.
1 Bullock plough by School of Arts.
2 Bullock ploughs by Mint.
2 Bullock ploughs by Ransomes and Sims.
1 Double mould board plough.
1 Large plough, with two wheels, by Ransomes and Sims.
1 Swing plough by Roorkee Workshop.
1 Wood swing-plough by Ransomes and Sims.
1 Wet land plough by Experimental Farm.
1 Wooden roller.
1 4-wheel waggon.
1 Stone trolley.

* Steam Engine transferred from Agricultural to Public Works Department.

1 Root-pulper by Ransomes and Sims.
2 Sets of iron harrows, with swingletree, by Ransomes and Sims.
3 Country carts.
1 Water cart.
1 Sewage cart, by Gun Carriage Works.
1 Maize sheller, by Ainsworth and Co.
1 Maize sheller, by Ransomes and Sims.
1 Drainpipe-making machine.
1 Corn drill.
1 Barrow drill, by Experimental Farm.
1 Rain gauge.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
1 Water elevator, by Experimental Farm.
1 English ladder.
1 Norton's tube-well with a rotary motion.
1 English grindstone.
1 Farm bell.
2 Wheel hand-hoes.
9 Cattle yokes.
2 Single bullock carts.
1 Overhead, bullock-power, with shafts and gearing.
1 Sugar-cane mill.
1 Californian pump.
1 Archimedian pump.
1 Cake-crusher.
1 2-wheel plough with cultivator, by Ransomes and Sims.
1 Pump, by Roorkee Workshop.
1 Chaff-cutter, manual-power.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon and Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
5 English carts.
1 Malabar spoon bale.
1 Waterproof cart cover.
1 Sack-barrow.
1 Portable scale with weights.
3 Picottah buckets.
2 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
14 Wheel-barrows.
3 Hay frames for carts.
1 Hand cart.
1 Subsoil plough.
2 Farm clocks.
5 Tables.
8 Chairs.
1 Writing desk.
5 Almirahs.
1 Iron cash chest.
2 Writing tables.
2 Book-shelves.
1 Dynamometer.
1 Surveying level with stand, staves, &c.
1 Set of bottle levels. Chemical Apparatus, Mortars and Pestles, Glass-breakers, &c.
29 Feeding tubs.
5 Metal feeding troughs.
1 Scythe.
1 Manure drag.
2 Bengal picks.
2 Dutch hoes.
10 Hoes.
10 Hand-hoes.
5 Forks of sorts.
2 Hand harrows.
7 Iron rakes.
32 Mamoties.
2 Hatchets.
1 Large field rake.
13 Crowbars.
16 Picks.
2 Mattocks.
2 Hedge shears.
3 Billhooks.
1 Iron real.
7 Grass knives.
4 Manure forks.
14 Digging forks.
1 Horse hoe.
6 Shovels.
4 Sets of bullock harness.
2 Surveying chains with pins.
2 Iron cisterns.
A quantity of wire rope, and a large number of details belonging to steam plough.
35 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Spade.
1 Ear punch for marking sheep.
1 Mercal, one half-mercal, and one measure.
1 Weeding spud.
3 Pairs of sheep shears.
1 Pruning knife.
1 Dibble.
A number of spanners.
4 Mallets.
4 Rammers.
1 Poultry feeding-cage.
1 Maize cobstand.
2 Driving wheels.

1 Large rubbish screen.
1 Drain scoop.
1 Lactometer.
1 Levelling board.
1 Single-barrel fowling piece.
1 Pair of pan scales.
1 Branding iron for marking sheep.
1 Theodolite.
1 Sickle.
1 Chester measure metallic tape, 66 feet.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1*st of April* 1874.

2 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
2 Country carts.
1 Box cart.
6 Reaping hooks.
6 Hand-hoes.
8 Picottah buckets.
1 Chopper.
20 Feeding tubs.
1 Levelling board.
2 Spades.
3 Small wheel-barrows.
1 Clock.
6 Digging forks.
7 Yokes.
8 Planters' hoes.
1 Tub for well.
1 Scythe.
1 Weeding spud.
1 Tarpaulin.
1 Measure.
1 Half-mercal.
1 Scale triangle, weights, &c.
1 Large beam and cattle-weighing scale.
9 Fifty-six pound weights.
15 Plough shares.
1 Table.
2 Hand-hoes.
1 Knife.
1 Hay fork.
1 Mamoty.
1 Pair pincers.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Bell.
1 Water cask.

List of Tools, &c., belonging to the Implement Workshops on the 1*st of April* 1874.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
18 Tongs.
3 Bellows.
2 Screw plates.
4 Sledge hammers.
6 Small hammers.
6 Chisels, " Smith's."
8 Punches.
1 Countersinking punch.
4 Dies or flat chisels.
2 Pairs calipers.
1 Iron square.
2 Round files.
4 Half-round files.
3 Flat files.
21 Taps for screw plates.
1 Iron brace and five bits.
1 Filer's hammer.
1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
1 Square file.
1 Angular file.
1 Bob drill and taps.
2 Screw liners.
1 Bench with 2 vices.
3 Hand saws.
1 Pit saw.
1 Cross cut saw.
7 Augers.
2 Jack planes.
1 Spoke shove..
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
6 Carpenter's chisels.
1 Cold chisel.
2 Set squares.
1 Angle square.
6 Gimlets.
1 Brace with 37 bits.
2 Adzes.
1 Hammer.
1 Turn-screw.
1 Plummet.
4 Saw files.
4 Rasps for wood.
1 Mallet.

List of Books added to the Apprentices' Library during the year 1873-74.

Transactions of the Agricultural and Horticultural Society of India, 8 Volumes, 1829, 1836, 1837, 1837, 1838, 1839, 1840, and 1841.
Leaves from the Book of Nature, by M. S. DiVere, 1856.
Instructions for the use and application of Pyrimont Seyssel Asphalte, 1860.
Rudimentary Treatise on Clay Lands and Loamy Soils, by Professor Donaldson, 1852.
Rudimentary Treatise on Mineralogy, by D'Varley, 1849.
Rudimentary Treatise on the Drainage of Districts and Lands, by G. D. Dempsey, C.E., 1849.
Bingley's Elements of Useful Knowledge, by Rev. William Bingley, A.M., 2 Vols., 1831.
Lardner's Cabinet Cyclopœdia on Heat, by Dr. Lardner, 1833.
Odling's Practical Chemistry, by William Odling, M.B., F.C.S., 1854.
Illustrated Geology, by F. C. Bakewell, 1856.
Botanist's Companion, by Professor Balfour, 1860.
Letheby on Food, 1872.
New Farmer's Almanac, by John C. Morton, 1866.
Do. do. do. 1868.
The Practical Sugar Planter, by Leonard Wray, Esq., 1848.
Elementary Chemistry.
Elements of Geometry, by Commissioners of National Education in Ireland, 1857.
Hints to Horsekeepers, by Henry William Herbert.
Allen's Rural Architecture, by Lewis F. Allen.
Boussingault's Rural Economy, by J. B. Boussingault.
Caldwell's Agricultural Chemical Analysis, by G. C. Caldwell.
The Forest Tree Culturist, by Andrew S. Fuller.
Milch Cows, by M. Francis Guenon.
Tobacco Culture, by 14 Experienced Cultivators.
Turner's Cotton Planters' Manual, by J. A. Turner.
The Carpenters' and Joiners' Handbook, by H. W. Holly, 1872.
The Mule, by Harvey Riley, 1869.
The Young Farmer's Manual, by S. Edward Todd, 2 Volumes, 1870.
Hop Culture, by 10 Experienced Cultivators.
Familiar Letters on Chemistry, by Justus von Leibig, 1859.
Elements of Agricultural Chemistry, by Thomas Anderson, M.D., 1860.
Principles of Agricultural Chemistry, by Justus von Leibig.
The Principles of Agriculture, by William Bland.
Scientific Farming, Made Easy, by Thomas C. Fletcher, 1861.
Chemistry in its relation to Physiology and Medicine, by George E. Day, M.A., &c.
Johnston's Experimental Agriculture, by James F. W. Johnston, M.A., &c., 1859.
The Sheep, by W. C. L. Martin, 1862.
The Pig, by W. C. L. Martin, 1860.
Pneumatics, by Charles Tomlinson, 1858.
Rudimentary Mechanics, by Charles Tomlinson, 1858.
Rudimentary Treatise on Well-digging, Boring, &c., by J. G. Swindell, 1859.
Rudimentary Treatise on Blasting and Quarrying of Stone, by Major-General Sir John Burgoyne, K.C.B., 1849.
Art of Constructing and Repairing Roads, by Henry Law, C.E., 1855.
How to observe "Geology," by H. T. DeBeche, F.R.S., 1836.
Horsekeepers' Guide, by James Mills, M.V.C.S.
Act No. I. of 1871, English.
Papers relating to Tea Cultivation in Assam, 1861.
Selections from the Records of the Madras Government, No. 23, Reports on the Fibres of Southern India, 1856.
Report upon the Present Condition and Future Prospects of Tea Cultivation in the North-West Provinces, 1860.
An Essay on the Culture and Manufacture of Indigo, by John Shortt, M.D., 1862.
Journal—Amusement for idle hours, and hints for the improvement of the resources of India.
The Earth, Plants, and Man, by Joachim Frederic Schoun, 1859.

Manual of Technical Analysis, by Bolley and Paul, 1857.
First Lessons in Geology, by Gidean Algernon, by Mantell, L.L.D., F.R.S., 2 Volumes.
Orr's Circle of Sciences, Elementary Chemistry, by John Scoffern, M.B., 1855.
Orr's Circle of Sciences, Geology, Mineralogy, and Crystallography, by Professor D. T. Austed and Professor Tennant, F.G.S., 1855.
Principles of Comparative Physiology, by Dr. Carpenter.
American Agriculturist, 1869—71.
The Illustrated Farmers and Gardeners' Almanac, 1873.
Orr's Circle of Sciences.
The Journal of Agriculture, January to June 1868.
Report on Caoutchouc, by James Collins, 1872.
Cotton—An account of its Culture in the Bombay Presidency, by Walter R. Cassels, 1862.
Collectors' Reports on the System of Agriculture followed by Ryots in the several districts of the Madras Presidency.
Madras Revenue Administration Report for 1870-71.
Do. do. for 1871-72.
Do. do. for 1872-73.
The Journal of the Royal Agricultural Society of England, Vol. VIII., Part II., 1872.
Do. do. do. Vol. IX., Part I., 1873.
Mantell's Medals of Creation, by Gideon Algernon Mantell, L.L.D., F.R.S., &c., Vol. I., 1853.
Do. do. do. Vol. II., 1853.
Report on the production of Tobacco in India, by J. E. O'Connor, 1873.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST OF MARCH 1875.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT GAZETTE PRESS.

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2. Government Farms' Expenditure.
3. Valuation of Live and Dead Stock belonging to the Experimental Farm.
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THE ANNUAL REPORT OF THE SUPERINTENDENT OF GOVERNMENT FARMS, FOR THE YEAR ENDING 31ST OF MARCH 1875.

GENERAL.

SEASON, &c.

1. *Weather.*—The rainfall registered at the Sydapet Experimental Farm during the past year amounted to 68·98 inches, against 47·23 inches, the average annual fall of the previous ten years. The amount of rain that fell would have been quite sufficient for the requirements of agriculture, had it been more evenly distributed throughout the year, but it was chiefly precipitated in heavy showers at very irregular intervals; though the fall was much higher than the average annual fall, there were only fifty-nine wet days, against seventy-three, the average number of wet days in each year during the previous ten years; thus, on the average, there was 1·17 inches of rain registered for each day on which rain fell.

2. There was no rain whatever in April. There were three wet days in May, and during these three days the fall was 6·79 inches, giving an average of 2·26 inches for each wet day. In June the rainfall was 6·66 inches, which fell on seven days; the average fall on each day was ·95 inches. In July there were eight wet days, and the quantity of rain registered was 5·46 inches, giving ·68 inches as the fall for each day. During the next month the rainfall was much lighter, only 2·34 inches precipitated on five days, giving an average of ·47 inches for each day on which rain fell. September was an unusually wet month; there were twelve days on which rain fell, while the quantity collected was 10·59 inches, or more than double the average fall in this month, during the ten previous years. The total fall in October was 21·91 inches precipitated on ten days, an average of 2·19 inches per wet day; though the fall was so heavy, there was only one day previous to the 16th of the month on which rain fell, and there were only three wet days on which the quantity of rain registered was less than one inch, while on the 23rd, 24th, and 25th the total amount collected was no less than 13·94 inches. The rainfall registered in November was only about half the quantity usually registered in this month; there were seven wet days and the fall amounted to 9·25 inches, or 1·32 inches per day. Rain fell only on five days in December, during which 5·11 inches were collected, giving an average of 1·02 inches for each day. During the remaining three months of the year the quantity of rain collected was only ·87 of an inch, which fell on two days.

3. The following table shows the amount of rain that was registered during each month of the year, and the number of days in each month on which rain fell, compared with the average monthly registrations of a similar kind for the preceding ten years:—

	1874-75.		Average of the previous 10 years.	
	Inches.	Wet days.	Inches.	Wet days.
April	...	...	0·28	0·8
May	6·79	3	0·84	1·3
June	6·66	7	2·79	7·6
July	5·46	8	3 96	10·4
August	2·34	5	5·32	11·3
September	10·59	12	4·25	8·6
October	21·91	10	8 19	11·5
November	9·25	7	14·14	13·4
December	5·11	5	5·39	6 0
January	0·10	1	1·08	1·4
February	...	..	0·91	0·9
March	0·77	1	0·08	0·4
Total ...	68·98	59	47·23	73·6

4. The next statement exhibits the rainfall of the year made out in weekly totals.

——	1874-75.		Average of the previous 10 years.		——	1874-75.		Average of the previous 10 years.	
	Inches.	Wet days.	Inches.	Wet days		Inches.	Wet days.	Inches.	Wet days.
1st Week...	...	...	·22	·2	28th Week..	...	...	·80	1·7
2nd do. ...	...	...	·03	·2	29th do. ...	3·23	2	4·00	3·8
3rd do. ...	...	...	...	...	30th do. ...	17·53	7	1·22	2·8
4th do. ...	...	...	·04	·3	31st do. ...	...	...	1·73	2·2
5th do. ...	5·80	1	·76	·4	32nd do. ...	1·40	2	2·11	2·5
6th do. ...	·71	1	·01	·3	33rd do. ...	·10	1	2·26	3·1
7th do. ...	...	...	·04	·2	34th do. ...	·25	1	4·19	3·6
8th do. ...	·28	1	·03	·3	35th do. ...	7·50	3	5·33	3·8
9th do. ...	...	...	·14	·3	36th do. ...	...	...	3·50	2·4
10th do. ...	4·93	4	·68	1·1	37th do. ...	5·01	4	·62	1·3
11th do. ...	·42	1	1·20	2·3	38th do. ...	...	...	·36	·7
12th do. ...	...	...	·34	1·9	39th do. ...	·10	1	·19	1·0
13th do. ...	1·31	2	·44	2·1	40th do. ...	...	...	·03	·4
14th do. ...	·84	1	·20	1·3	41st do. ...	...	...	...	...
15th do. ...	1·58	3	1·26	2·5	42nd do. ...	...	...	·58	·6
16th do. ...	2·26	3	·76	3·1	43rd do. ...	·10	1	·47	·2
17th do. ...	·78	1	1·07	2·5	44th do. ...	...	...	...	...
18th do. ...	...	...	1·30	2·5	45th do. ...	...	...	·70	·6
19th do. ...	·99	3	1·54	2 8	46th do. ...	...	...	·02	·1
20th do. ...	1·10	1	·55	2·5	47th do. ...	...	...	·12	·1
21st do. ...	·25	1	1·38	2·1	48th do. ...	·77	1	·07	·1
22nd do. ...	2·55	1	1·36	2·7	49th do. ...	...	...	·08	·4
23rd do. ...	2·41	5	·66	2·2	50th do. ...	...	...	...	...
24th do. ...	2·82	2	·87	1·8	51st do. ..	...	...	...	...
25th do. ...	·50	1	1·54	2·4	52nd do. ...	...	...	...	...
26th do. ...	2·31	3	1·00	1·7					
27th do. ...	1·15	1	1·43	2·2	Total ...	68·98	59	47·23	73·3

OFFICE-WORK.

5. The large amount of arrears of office-work, which had accumulated prior to the appointment of my Assistant, is rapidly being reduced. I trust to be able to overtake this work before next cold season, if I can remain at my Head-Quarters until then.

6. The following professional questions, which are a few selected from those put in the demi-official letters received by me during the past year, have been answered :—

Presidency, Province, or District from which the Questions came.	General Nature of Questions.
Tanjore	Asking what foods are best suited for use in fattening cattle and sheep.
Do.	Asking for advice regarding a course of reading on agriculture.
Mysore...	Asking for information regarding the cultivation of maize as a field crop.
Nilgiris	Asking for an explanation regarding the differences in the action of two mixtures of manures which had been applied to land planted with coffee.
Coimbatore District...	Asking opinion regarding the nutritive values of certain grasses.
Chingleput District ...	Asking for advice regarding the cultivation of Guinea grass.
Rajpootana.	Asking advice regarding the reclamation of soil covered by an efflorescence of salt.
Cuddapah District ...	Asking opinion regarding a proposal to introduce a steam plough into the district for general agricultural use.

Presidency, Province, or District from which the Questions came.	General Nature of Questions.
Ganjam	Asking for information regarding the cultivation and uses of *Sorghum Saccharatum*. Also for details of Carolina paddy cultivation.
Hyderabad	Asking for information regarding foods best suited for feeding dairy stock and for fattening cattle and sheep.
Tanjore	Asking for advice regarding the sub-soil drainage of swamp land.
KistnaDistrict	Asking for advice regarding the adoption of improved methods of cultivation.
Travancore	Asking for advice as to the improved agricultural implements and tools best suited for the use of the ryot.
Coimbatore District...	Asking advice regarding the cultivation of plants with large fleshy roots.
Bombay	Asking for information regarding the cultivation of Carolina paddy.
Punjab...	Asking advice regarding a course of reading on agriculture.
Nilgiris	Asking advice regarding the feeding of stock on ground-nut cake.
Chingleput District...	Asking for advice regarding the cultivation of Casuarina trees.
Nilgiris	Asking for advice regarding reaping machines in view to the selection of one for cutting grass on the rough grass land of the district.
Wynaad	Asking opinion as to the action of lime on a soil, and the quantity to be applied to a soil under coffee cultivation.
Mysore	Asking advice as to the treatment of sheep newly imported from Europe.
Travancore	Asking for advice regarding the analysis of a soil.
Nilgiris	Asking advice regarding the selection of a chaff-cutter suited for the use of a planter.
Coimbatore	Opinion asked regarding the quality of a sample of tobacco and of wheat.
Wynaad	Asking advice regarding the selection of a chaff-cutter for use on a coffee estate where a large number of cattle are kept.
Cuddapah	Asking for information regarding the construction of a "double mhote" for raising water.
Trichinopoly	Asking for advice regarding the selection of a breed of sheep for introduction into the district.

Agricultural Apprentices.

7. In the Sydapet Farm Class there were at the close of the year six apprentices; the only change that took place in this class during the past year was the removal of one of the youths from the class, who had obtained employment as a Farm Overseer in Mysore, and the appointment of another youth to fill the vacancy his removal caused.

8. The District Farm Class at the close of the year consisted only of two apprentices, it having been thought unadvisable to fill up the vacancies that had occurred in this class, pending the receipt of the decision of Government regarding the whole question of agricultural education, which question had, for some time, been under consideration.

9. The District Farm class was examined in June last. The following are the results of that examination :—

———	Full Marks.	A.	B.	C.
Paper Examination.				
1. Mention what crops are growing in fields Nos. 8, 10, 13, 14, and 23 ?	5	4	4	5
2. Mention the hours during which the draught cattle are daily employed	5	5	5	5
3. What area of land, under a crop drilled 18 inches apart, can be hoed by a bullock hoe during an ordinary working day, the land being in good condition ?	5	...	...	...

	Full Marks.	A.	B.	C.
PAPER EXAMINATION.—(*Concluded.*)				
4. On the Experimental Farm in what month are the ewes generally put to the ram? and in what month are most of the lambs born? also, in what month are the lambs usually weaned?	10	8	8	10
5. If a plough travels at the rate of 1½ miles an hour, turning a furrow slice 9 inches wide, what area of land will it plough during a working day of 8 hours, assuming that 25 per cent. of the time is lost in turning at the head-lands?	10	5	8	...
6. What is the average cost at present on the Model Farm of excavating a cubic yard of earth and carrying it a distance of 20 yards?	5	5	5	5
7. Mention the number of permanent (broad) incisor teeth and the number of temporary (milk) incisor teeth in the mouth of a three year old sheep	10	...	...	...
OUT-DOOR EXAMINATION.				
1. *Ground-nut Oil-cake.*—Recognise? Why is it used on the Sydapet Farms in preference to other kinds of feeding stuff? What quantity is given per head to each kind of stock? What price is paid for it per 100 lbs.?	10	9	9	3
2. *Seed Drill.*—Explain how it works when sowing, and how it can be altered to enable it to sow in lines with narrow or wide intervals between; and how the depth at which it sows is regulated?	5	5	5	5
3. *Winnowing Machine.*—Explain its construction and the uses of its various working parts	5	5	3	...
4. *Expanding Drag Harrow.*—Explain its uses, and mention the advantages possessed by such a harrow over one of the ordinary kind	5	3	5	2
5. *Bullock Hoe.*—Explain its construction and its uses	5	3	5	2
6. *Sheep.*—Point out in the flock a good specimen, and state in detail why the selection is made	5	4	4	3
7. *Poultry.*—What breeds of poultry have succeeded best on the Experimental Farm? In what respect do the birds of the breed now kept differ from ordinary country fowls?	5	4	4	1
8. *Mauritius Maize.*—Recognise variety? What quantity of seed per acre should be sown? How should the land be prepared for maize? When should maize be sown in this district? and when is the crop usually harvested?	10	8	8	6
Total ...	100	68	73	47

10. I have again and again, in my reports, drawn attention to the many imperfections of the system of training, under which the youths in the apprentice classes at Sydapet are supposed to gain a knowledge of agriculture, and have pointed out, more especially, the mistake of trusting entirely to field-training to qualify Hindoo youths as agriculturists; and I am glad that this view is now held by Government who, in a recent Order, sanctioned the abolition of these apprentice classes, and authorised instead the Establishment of a School of Agriculture in which youths of the class to which these apprentices belong, and others desiring to become agriculturists, may meet with facilities for gaining a thorough knowledge, both practical and theoretical, of agriculture.

Permanent Improvements on the Sydapet Farm Estate.

11. The services of one of my Assistants being available for employment, I thought it advisable to avail myself of the opportunity thus afforded me for carrying out, under competent superintendence, certain extensive works of improvement on this property, which, in most instances, had been allowed to stand over during a considerable period owing to my inability from pressure of work to undertake them.

12. Amongst other improvements undertaken were the following:—A new road, measuring nearly a mile in length, was opened on the eastern side of the estate; this road connects the Model Farm roads with those on the Experimental Farm; the portion that runs through the Model Farm is of great use in affording the means of gaining access to land which previously could not be reached by carts. The surface of nearly all the undulating sandy land on this property has been greatly altered and in many cases terraced; this was done in view to prevent further injury to the soil during heavy rains, by inducing a larger proportion of the water that falls to pass down into the soil. I had at one time hoped that it would have been possible to have avoided undertaking this heavy work, but further experience proved that it was unwise to persist longer in the attempt to bring these sandy slopes into a good cultivatable condition by manure and cultivation alone. These soils, which contain on the average from 90 to 95 per cent. of sand, would retain nothing in the shape of manure during heavy rains, the manure being almost entirely washed out of the land and carried with a finer particles of the surface soil away down to lower levels. The surface of a considerable area of other land situated within the limits of the Model Farm was also greatly altered to enable the land to benefit by occasional irrigation from the Marmalong Tank, and by water to be brought by the new channel from the Chembrumbakum Tank. On the Model Farm a large amount of work was executed in re-forming the beds under which the wet land was divided, which was rendered necessary by the crooked, irregular boundaries of these beds interfering so greatly with the cultivation and with the irrigation and drainage of the land. On the same Farm a small plot of land, which was in a very swampy condition, was thoroughly sub-soil drained and rendered dry and healthy. A new boundary fence was constructed on the western side of the Experimental Farm. The necessary repairs were done to the various buildings on the estate. A number of Casuarina and other trees were planted over the property.

13. *Concrete.*—This material was largely used on the Sydapet Farms during the past year; it was generally formed of the following ingredients:—One part of lime, five parts of broken bricks, and two parts of sand, prepared as follows: the lime having been thoroughly slacked and the bricks broken up to about the size of walnuts, they were, with the sand, thoroughly mixed together while dry, after which a quantity of water was thrown over the heap, and the whole thoroughly blended.

14. The concrete has proved especially efficacious when used for protecting the floor and sides of drains in which the fall was great. The outfall of a large open drain through which a great quantity of water occasionally passes was much improved last year by being coated with this concrete; though built of large stones, it very frequently needed repairs; various simple means had been tried to protect the slope from damage, but none were at all successful, and stone-in-lime would

have been too costly. This outfall was particularly well suited to test the value of concrete as a protection where the wash is great, as the water was discharged from a height about 10 feet above the level of the drain beneath, and in its descent passed over the concrete covered slope. The result of the experiment has been most satisfactory. On another part of the estate, the arch of a small bridge was made with concrete, and, though it has been frequently submerged by the river, it has stood remarkably well. For making water channels, the concrete has proved most useful. The following result shows the cost that was incurred for making 72 running yards of channel, the inside dimensions of which were, depth 8 inches, and width 8 inches, the walls and floor being 4 inches in thickness:—

	Rs.	A.	P.
Breaking bricks—2 men, at 3 annas a day, and 13 women, at 2 annas per day	2	0	0
Refuse bricks and cart-hire	2	4	0
Mixing concrete and making drain—10½ coolies, at 3 annas per day ...	1	15	6
Lime for concrete—10 parahs, at 12 parahs. per Pagoda...	2	14	8
Lime for smooth coat—6 parahs, at 12 parahs per Pagoda	1	12	0
Bricklayers' hire for laying on smooth coat and finishing drain	3	7	0
Total ...	14	5	2
Per running yard	0	3	2

15. Concrete is a much cheaper material than brick-in-lime for many purposes in which the latter is employed, and its use ought to be much extended in this country where the bricks are generally so very inferior. A lime concrete, such as described, is not well suited for building walls above ground, for this purpose a cement concrete is generally used.

16. The following shows the cost at Sydapet of 100 cubic feet of concrete and of 100 cubic feet of brick built in lime:—

Concrete.	Rs.	A.	P.
Refuse bricks and cart-hire...	2	4	0
Sand, 2 cart-loads	0	4	0
Lime, 7 parahs	2	0	8
Breaking 35 parahs of bricks	0	10	0
Bricklayers' hire for building 100 cubic feet of concrete, at 3 pies per cubic foot	1	9	0
Total ...	6	11	8
Cost per cubic foot	0	1	1
Brick-in-lime.			
2,000 bricks	6	0	0
10 parahs of lime...	2	14	8
3 cart-loads sand	0	6	0
100 cubic feet of building, at 6 pies per cubic foot	3	2	0
Total ...	12	6	8
Cost per cubic foot	0	2	0

17. Concrete can be prepared from the refuse bricks of old buildings that are useless for any other purpose, road-making excepted; the more they are broken and covered by old mortar, the better they are suited for use in this way. Concrete will be of great value for many agricultural purposes in this country, and there is in most localities an abundance of material in the shape of old walls, tumble-down buildings, &c., the removal of which would considerably improve the appearance of many of our towns and villages.

SNAKES, &c., KILLED.

18. The following statement shows the number of snakes, rats, and squirrels killed on the Sydapet Farm Estate for which rewards were paid during the past year :—

Cobras	24
Other snakes	139
Squirrels and rats	532

A much larger number of snakes were killed in the previous year, and I hope that the small number killed last year may be taken as evidence that we are succeeding in killing down these dangerous pests, for there were peculiar facilities last year for killing snakes, as from the long drought the fields were bare during a much longer period than is usual, and I believe that the coolies are now as ready as ever they were to earn the small rewards given for killing snakes. There were no deaths during the past year amongst Farm coolies from snake-bite, but amongst the Farm live-stock there were several deaths that were attributed to this cause.

AGRICULTURE IN THE MADRAS PRESIDENCY.

19. The following facts throw some light on the real condition of agriculture in this Presidency, regarding which such opposite opinions are held :—

20. (*a*) *Small proportion of the area of the Presidency now utilized.*—The entire area of the Presidency comprises 138,318 square miles, or 88½ millions of acres ; of this, 50,623 square miles consist of permanently assessed properties, Government forests, and hill tracts, leaving 87,695 square miles, or 56,124,800 acres directly under Government. Of this 56 millions of acres, only 27⅓ millions of acres are under occupation ; there is thus nearly 30 millions of acres of Government land altogether unutilized.

21. (*b*) *Small revenue received from the land in the shape of rent.*—The total area under occupation last year was 27,360,000 acres, and the total rent collected was 34,933,583 rupees, which is only Rupees 1-4-5, or about 2*s.* 4*d.* per acre.

22. (*c*) *Low value of the produce of an acre of cultivated land. Dry land.*—During the last official year there were 13,895,331 acres under dry cultivation in the Madras Presidency (excluding South Canara and Malabar, for which I have no figures) that paid rent, amounting to 15,009,850 rupees, an average of Rupees 1-1-3, or about 2*s.* per acre. With these figures it is very easy to ascertain the average value of the produce of an acre of dry land by means of the formula used in fixing the rent in this Presidency, which is as follows :—From the money value of the estimated outturn, a deduction of one-quarter is made as an allowance for unfavorable seasons ; and from this remainder, the cultivation expenses are deducted, and thus the net value of the crop is ascertained, half of which forms the Government rent. Thus it is only necessary, in order to arrive at the net value of an average crop, to multiply by 2 the sum received as rent for one acre, which is Rupees 2-2-6, or 4*s.* To the amount thus obtained, we must add the cultivation expenses which are said by the Settlement Department to average about Rupees 4-10-3. By adding this sum to the net value of the produce already determined, we get Rupees 6-12-9 per acre ; to which if we add the one-fourth deducted to provide for unfavorable seasons, we will ascertain the average value of the produce raised on one acre of land under dry cultivation in this Presidency, which is Rupees 8-7-11, or about 15*s.* 7*d.* excluding the value of the straw, which is taken as a set-off against the keep of the cattle which forms no charge in the cultivation expenses. *Wet land.*—It is not quite so easy to arrive at the average value of the produce of an acre of land under irrigation. There were last year in the Madras Presidency (again excluding South Canara and Malabar) 3,105,622 acres under wet cultivation, for which, in the shape of rent, 16,873,137 rupees were received, which is Rupees 5-6-11, or about 10*s.* per acre. To ascertain the average value of the produce on one acre of this land, we must proceed in the same way as we did in determining the value of the produce of dry land ; thus, twice the amount of the rent represents the net value of the produce which is Rs. 10-13-10,

to this we add the cultivation expenses, which are said by the Settlement Department to average about Rupees 7-9-9 per acre, which, added to the net value of the produce, makes Rupees 18-7-7 per acre. In fixing the rent of wet land, the deduction made for unfavorable seasons is only one-sixth ; this, added to the figures previously obtained, brings up the total to Rupees 21-8-10, about two pounds sterling as the average value of the produce of an acre of irrigated land, less the value of the straw, which, for the reasons stated when referring to dry crops, is omitted in the calculation.

23. (*d*) *Small incomes of the Cultivators.*—It is very easy to ascertain the amount of income enjoyed by Cultivators in this Presidency, if the information contained in the previous paragraph is accurate ; thus it is only necessary to deduct the annual rent from the value of the produce of an acre of land, and the balance that remains is the income of the Cultivator and his family for their joint labors. If we take for illustration the renter of a holding of 12 acres, 10 acres of dry land, and 2 acres under irrigation, the annual income derived therefrom will be as follows :—

	Rs.	A.	P.
10 acres of dry land, the produce of which is valued at Rupees 8-7-11 per acre	84	15	2
2 acres of wet land, the produce of which is valued at Rupees 21-8-10 per acre	43	1	8
	128	0	10
Deduct rent, 10 acres of dry land, at Rupees 1-1-3 per acre, and 2 acres of wet land, at Rupees 5-6-11 per acre	21	10	4
	106	6	6

From this it would appear that the total income derived from a 12 acre holding to repay the Ryot for the labor of himself and family, and expenses incurred in cultivation throughout a year, would be in a favorable year only Rupees 106-6-6, and in an average year, deducting the one-fourth allowed for bad seasons, only Rupees 79-12-11, or about Rupees 6-8-0 per mensem equal to three shillings per week.

24. (*e*) *Large proportion of occupied land under fallow.*—Of the 27,360,000 acres under occupation, 4,996,000 acres were last year under bare fallow, produced no crop whatever, and paid no rent.

25. *(f) Low type of crops generally grown and the small area under crops that need manure and moderately good cultivation.*—Of the 22,364,000 acres under crops, food grains occupied 18,385,000 acres, of which 26,000 acres only consisted of wheat ; this crop is perhaps not so well suited for cultivation in the southern half of the Presidency, as it is for culture in the northern half ; but even in the districts peculiarly suited for its cultivation, it occupies but a miserable proportion of the land under food grains ; thus :—

District.	*Total Area under Food Grains.	Of which Wheat occupies.
		ACRES.
Salem	1,432,000	1,000
Nilgiris	34,000	3,000
Coimbatore	2,089,000	3,000
Kurnool	1,700,000	8,000
Bellary	2,909,000	6,000
Cuddapah	1,527,000	3,000
Kistna	1,657,000	2,000

*Includes some land twice charged, being cultivated with 2 crops during the year.

The area under wheat might be very largely increased especially in the districts to which I have just referred. Wheat requires moderately good cultivation with a fair allowance of manure; taking this into account in connection with the certainty that there is in this country a good market for wheat at renumerative prices, the miserable position it occupies in the cropping of the Presidency is, I think, conclusive evidence of the low condition of the agricultural practice pursued. Again sugarcane is another crop which requires manure and moderately good cultivation, and this occupied but 36,000 acres of the 22½ millions of acres under crop last year, and it grows well nearly in all parts of the Presidency.

26. (*g*) *The entire absence of any fodder or root crops raised for the food of stock.*—There is no crop especially grown for feeding stock which in any way resembles the fodder, roots, and other restorative crops of more civilized countries. Nearly every acre of the 22½ millions of acres was occupied by what is termed in agriculture an exhausting crop. As I have before pointed out, crops that need the liberal supply of manure are almost unrepresented in the cropping of this Presidency.

27. (*h*) *Low commercial value of the agricultural produce of Southern India.*—In the English Market, Madras cotton is generally from 25 to 50 per cent. less in price than American cotton; Madras rice is only about half the value of American rice; Madras tobacco will scarcely command a sale, excepting for the manufacture of sheep washes. Indigo, coffee, and tea command good prices, but then these are produced under European management.

28. (*i*) *Poverty of the arable soils of the Presidency.*—In the absence of analyses of the different arable soils of the Presidency it is exceedingly difficult to produce proof of their poverty in plant food, as the small crops obtained may be the result of inferior cultivation rather than due to the poverty of the soil. Though I am unable to produce evidence as conclusive as I should desire, I am able, from the results of the investigations made by Mr. Broughton regarding the quality of country tobacco, to produce some facts which throw a great deal of light upon the matter. Mr. Broughton determined only the quantity of carbonate of potash in the ash of the tobaccos he examined, however, the quantity of this mineral in the ash of the tobacco plant bears a very close relation to the quantity in the soil that produced the tobacco, and therefore the information gathered by Mr. Broughton possesses considerable value as indicative of the quantity of potash in the arable soils of the Presidency. The following are the results:—

Districts in which Tobacco was produced.	Number of Analysis.	Average per cent. of Carbonate of Potash in Ash.
Vizagapatam	7	9·76
Trichinopoly	6	6·01
Bellary	4	6.22
Nellore	2	6·96
Cuddapah	12	4·39
Tanjore	1	8·71
North Arcot	5	4·58
South Arcot	3	11·29
Nilgiris	2	17·81
Kurnool	5	5·73
Coimbatore	13	7·68
Kistna	10	13·52
South Canara	1	5·6
Madras	5	·70
Chingleput	2	·63
Madura	15	7·02
Salem	4	8·05

For comparison I give below a statement showing the quantity of potash in a few samples of tobacco produced in other countries :—

	Per cent.
Maryland tobacco	40·7
Do. do.	47·4
Massachusetts do.	47·8
Hungarian do.	26·46

Professor Emil Wolff of the Royal Academy of Agriculture, Wirtemberg, publishes seven analyses of tobacco, the ashes of which contained on the average 27·4 per cent. of potash, and one sample of which contained as much as 54 per cent. There is a very marked difference between the quantity of potash in the ash of tobacco raised in this Presidency, and, in other countries due, I think, entirely to the different quantity of potash in the soil.

29. To show what an important part potash plays in the food of plants, I would direct attention to the following, showing the quantity of potash in the ash of some of our more important agricultural products :—

	Per cent.
Potatoes	59·8
Turnips	39·3
Lucerne	25·3
Cotton lint	41·20
Cotton seed	35·44
Wheat	31·1
Barley	21·9
Maize	27·0
Paddy	18·4
Cholum	11·9

The deficiency of potash in the arable soils on which tobacco is grown, which are always more highly cultivated and manured than any other soil under crops, is, I think, strong evidence that our soils are gradually becoming exhausted.

30. The yield of the soils is also worth considering ; thus, while in Madras, the Ryot is contented to get 70 or 80 pounds of clean cotton per acre, the American Farmer is not contented unless he gets from 450 to 500 pounds per acre. The same with rice ; an average crop of paddy in this Presidency is about 15 bushels per acre ; in America, 70 bushels is no unusual crop. In Madras a maize crop of 10 bushels per acre is a good one ; in America crops of this grain vary from 50 to 80 bushels, and sometimes even amount to 100 bushels per acre.

31. (*j*) *The inferiority of the agricultural live-stock of the Presidency.*—The inferiority of our live-stock, with some slight exceptions, is so universally admitted that I need only mention this fact as another evidence in proof of the low condition of our agriculture.

Swamp Irrigation, &c.

32. I should be extremely sorry if any observations I have made in former reports, deprecatory of the irrigation practice of our Ryots, should be, in any way, accepted as antagonistic to irrigation, for no one can more highly appreciate the benefits that arise from the proper use of irrigation water than I do. It was the abuse of irrigation to which my condemnatory observations applied ; the almost universal practice in this country being to swamp the land instead of to irrigate it. It is exceedingly difficult to ascertain with any degree of accuracy the quantity of water that a Ryot would be contented to use in the cultivation of an acre of paddy ; he appears to think that he cannot use too much when the only trouble he is put to is to open a sluice. The following extract from a note by the Acting Chief Engineer for Irrigation on a report of an irrigation experiment made in the Godavery District in 1872 throws some light on the subject :—

"4. The actual quantities of water supplied per hour per acre, both artificially and by rain, are noted in the margin; water was first supplied on the 5th of May for the preparation of the seed-beds, and the last supply was obtained on the 20th of November. It is not stated when the crop was transplanted, but probably late in June or early in July, and hence the average supply during the season must have been about 4·87 cubic yards per hour per acre—a quantity which is known to be far above what is required." In the report on the experiment, it is stated as follows :—"3. The Cultivator was allowed to take water as he wished, but was looked after by a Lock Superintendent who lives near the spot, and a Delta Superintendent who frequently visited it, and they were supposed to see that he did not wilfully waste the water. The water could not be passed on to other cultivation." Here we have an instance of a sheet of water, an acre in extent, and 9 feet deep, used in addition to a rainfall of 26 inches, to bring to maturity one acre of paddy, and this, under the superintendence of Irrigation Officers, whose presence undoubtedly contributed to lessen the quantity of water that would otherwise have been used. I have no reason to suppose that this Ryot was more greedy in the use of the water than are other Ryots, who are equally favorably circumstanced for getting a supply. The quantity used in other irrigation experiments, made by the Public Works Department, varied from 6 feet to 7 feet in depth in addition to the rainfall to mature a crop of paddy. My experience proves that under moderately good cultivation, with a soil of fair average quality, a volume of water, one acre in extent, and about 4 feet in depth, would be ample for the production of one acre of paddy. Not only does swamp irrigation cause an enormous waste of a valuable producing power, but it is highly prejudicial in many other ways; the health of the people is injured; the soil is rendered unfit for cultivation, except under semi-aquatic crops of low types; and the capabilities of our irrigation works are seriously lessened by the smaller area thus watered. The following extract from a report on irrigation as practiced in Spain by Mr. Clements Markham is well worth consideration in connection with the subject on which I am now writing :—

	C. Yards.
From 5th May	·81
,, June	1·57
,, July	4·29
,, August	3·59
,, September	3·07
,, October	7·32
To 20th November	6·09

"The cultivation of rice around the shores of the Albufera was introduced by the Arabs, and was prohibited on account of its unhealthiness and the waste of water it occasioned, by King Martin of Aragon in 1403 A.D. Permissions and prohibitions have alternated since that time, and Cavanilles recommended the total discontinuance of a cultivation which produced so many fevers and such swarms of mosquitoes. Attempts have been made near Valencia to grow rice without irrigation, but they were fruitless.

"It would certainly appear that, apart from its extreme unhealthiness, the cultivation of rice in this country is open to serious objections. The continuous harvests and incessant swamping wear out and enervate the land, and now the use of guano and other manures is essential. The rice is sown in April and May, and reaped in September, so that the swampy land is seldom exposed to the influence of heat, and the stagnant water keeps it in a constant state of saturation, and rapidly neutralizes its fertilizing properties. At present the cultivation of rice is very strictly prohibited beyond certain prescribed limits, and the use of guano as manure is believed to have decreased the pernicious effects of the swamped land, though in what way it is difficult to understand."

33. Indigenous paddy from long cultivation as a semi-aquatic crop has become peculiarly adapted for swamp culture, especially in the formation of its roots, which consist of a net-work of horizontal fibres, particularly well suited to support the plant on semi-liquid mud, and it is for this very reason that the plant is not suited immediately for drier cultivation, for, directly the soil is allowed to become at all dry, these surface roots are scorched by the sun and the plant withers; nevertheless, it can be cultivated successfully with a much less quantity of water than is

now frequently used; but for cultivation on wet land with a less expenditure of irrigation water, it would be better to select a variety of paddy the roots of which have a greater tendency to go down into the soil.

34. Though it may be true that the Indian Ryot seldom or never thinks of providing means for the removal of the excessive quantity of water he pours on his land during the cultivation of paddy, the Cultivators of this grain in other countries are not so neglectful; in the aggricultural newspapers, published in the Southern States of America, I frequently meet with with inquiries addressed to the Editors, asking for advice regarding the treatment of paddy land. One correspondent, writing to the Editor of the Southern Cultivator, which is published in Georgia, in February 1874, writes as follows :—

"I write at the request of a friend who plants a thousand acres of rice, **** the ditches run from bank to bank at itervals of 30 feet, cut 3 feet deep, leading into side drains which are parallel with the embankments, cut 4 feet deep by 5 feet in width, emptying into a canal 6 feet deep by 30 feet clear water-way. You will see from this that the drainage is as thorough as practicable." The Editor, in reply, recommends still further attention to drainage. Another correspondent, an old South Carolina Rice Planter, in a letter to the "Rural South Land," published in New Orleans, in February 7th of last year, says :—

"Our rice planters should bear in mind the fact that, in order to obtain the best results, their rice lands must be thoroughly drained." And as regards Spain, Mr. Markham, in the report before alluded to, says :—

"One of the most important parts of the Murcian irrigation system is that which provides for the drainage of surplus water. The sub-soil is a stiff tenacious clay, and arrangements for preventing the accumulation of stagnant water and the formation of swampy ground are particularly urgent. The irrigating channels flowing from the right bank of the *Azequia Aljufia* terminate at the river, but those from the left bank are led down the valley, and have no natural outlet for their surplus water. Very deep trenches, called *azarbes*, are, therefore, dug in the lower part of the garden of Murcia, which receive, not only the unused water of the channels, but also the drainage of the irrigated land."

35. It is frequently remarked by persons, who ought to know better, "that, if the Indian Ryot knows but little regarding dry-land cultivation, he has nothing to learn regarding wet-land culture." This is, I think, a most serious mistake, for, as far as my experience goes, the cultivation of wet land in this country is but little, if at all, superior to the cultivation of dry land. To produce an average crop on a good soil, with the aid of an abundant supply of water, is no test of the quality of the farming practiced; the question is whether this good soil could not, with half the quantity of water generally used, be made to produce as good results; and in this way double the area under irrigation, at the same time improve the sanitary condition of the country and maintain the productive powers of the soil over a longer period.

Treatment of Salt Lands.

36. I have had but little personal experience in the treatment of land rendered barren by an excess of salt. There were on the Sydapet Experimental Farm two or three plots of very limited areas, on which, in dry weather, there was a light covering of salt, caused evidently by the absence of sub-soil drainage, the plots in each instance being surrounded on two sides by water, the ordinary level of which was only a few inches below the surface of the land. I tried various means to get rid of this excess of salt, but none were quite successful. Amongst the means tried were dressings of different mineral manures, such as carbonate of lime, sulphate of lime, ashes, &c., deep ploughing, frequent surface washings by fresh water, and dressings of sand and of farm-yard manure. Of these, the last mentioned produced the best results. I tried various crops on the land, which were known to be salt-feeders, but in no instance did I succeed in

obtaining a fair covering of plants, or in bringing any to maturity. I have had many opportunities for ascertaining the conditions under which, in this Presidency, salt generally appears on arable soils. From the Kistna District, in which large areas of land have been injured from this cause, I received from the late Mr. Boswell, the Collector, much valuable information and a large assortment of samples of the different soils so injured. From this and other information I have collected, I am strongly inclined to believe that the only effectual way of curing permanently the land so injured is to drain it thoroughly by means of sub-soil drains. The following information may, however, prove interesting and in some cases be of use. It refers to the method adopted by the Ryots of the Coimbatore District in treating land rendered unfertile by an excess of salt. The information was collected by the Tahsildars of the district, and was kindly placed at my disposal by the Collector, Mr. Wedderburn.

37. *Coimbatore Tahsildar's Report.*—"Salt lands are first levelled and subdivided into plots by banks one-and-half feet high. The plots are then manured by the plants peranday, milkhedge, kolanji, yerukalay, auvaray, púngay, and other plants and creepers, and these plants are trod into the mire as well as excreta of cattle, &c. If these plots are occasionally watered for twenty days, the plants will not have a bad smell and mix with the earth. The salt is taken off by the fermentation which these plants produce. This method should be practised twice a year, and that for three years."

38. "There is another mode of improving salt lands. The skins of several kinds are soaked in water till they have a bad stench. This water with hairs, &c., is applied to the plots which are watered again. After a period of about ten days this water is drained off and the land is again watered."

39. "But the salt will come up again in lands improved thus if there is excessive rainfall in the proper season of the year."

40. "The rich Ryots will practise these methods often and often and keep their land free from salt. But the poor Ryots are unable to manure their land so often; their land once improved again gets impregnated with salt."

41. *Suttimungalum Tahsildar's Report.*—"The lands are first ploughed and watered, then the following plants, &c., are applied to them to take off the salt, *i.e.*, kolinji, auvaray, yerukalay, peranday, púngay, prickly-pear, silt sand, and dust. This method the cultivators practise for two or three years. In some places prickly-pear is raised in the salt land and left to grow for four or five years, after which the plants are cut and the land ploughed and cultivated. In the same manner aloes are planted on such lands and allowed to stand for three or four years. These two plants, the cultivators say, eat off the salt from the lands."

42. *Collegal Tahsildar's Report.*—"To improve the salt lands which have best soil half or one foot below the surface, the Ryots, after well ploughing the lands, collect water in them, and after draining the water off they apply to them manure and plants, such as yerukalay and others. And when the lands have extracted all the juice of the plants, they cultivate them. But, if there is no good soil many feet below the surface, such lands are excavated to the depth of half a-yard and the pits so made are filled either by good soil or silt. These improvements are done to wet lands only. In case of punjah lands such a trouble is not for the most part taken. The lands of this kind are improved in course of years by manuring them with sweepings, ashes, and other manure."

43. *Perindooray Tahsildar's Report.*—"It appears that the cultivators apply to their salt lands the following plants, &c., to take off the salt from the land, *i.e.*, peranday, yerukalay, auvarary, kolinjy, leaves of púngay, milkhedge, and vélan bark after the arrack is extracted from it. They tread these plants into the land and plough it over and over again, and continue the method for two or three years. If the salt remains in the field after this improvement, they raise in the fields dams two or three feet high and collect the water in the fields; this they practise

in three or four years. If improved in this way, the salt no doubt goes away from the field. Expense for raising these dams is not great because they do this gradually."

44. *Cavoor Tahsildar's Report.*—"To salt lands which are cultivated with wet crops the people apply, after they are watered and ploughed, the following plants, *i.e.*, peranday, aloes, thoombay, yerukalay, auvaray, milkhedge and leaves of pungay and peroomarum, and to garden lands they apply the ears of cumboo after taking the grains off in addition to the above-mentioned herbs."

45. These they put in their fields ploughed and watered, tread them in the mire, and keep the field in this state till the plants are rotten. If prepared thus, the salt will go out. In punjah (dry) lands dams are raised in the fields to collect water from the rain and then the water drained off together with the salt."

46. *Pollachy Tahsildar's Report.*—"On punjah (dry) salt lands the Cultivators apply the chaff of grains, sweepings, and other manure for three or four years, and these take off the salt from the land. If there be excess of rain, the lands thought to be freed from the salt will become unfit for cultivation. For wet lands they apply kolinjy, yerukalay, and peranday, after draining the land ploughed and prepared for the purpose. These plants are rotten and then get mixed with the mire. They again plough the field and apply to it the sweepings and stalks of raggy, &c. Thus the salt is taken off the lands. This process is carried on every year; one year's improvement is of no use."

47. *Palladum Tahsildar's Report.*—"The fields are first levelled to collect the water from rain, then the plants, aloes, kolinjy, yerukalay, and milkhedge are mixed with the mire. Afterwards the fields are divided into plots as the wet lands are and cultivated for two years with paddy. At times the silt of the beds of tanks is placed in the field. These, the Cultivators say, are the methods by which the salt is taken off the fields."

48. *Dharapuram Tahsildar's Report.*—"It seems that Cultivators manure their salt lands by the plants peranday, kolinjy, and aloes, and then plough it twice or thrice. Some people make their salt lands fit for cultivation by spreading over them to the height of a span the loose sand blown by wind."

49. "Another method of improving salt land is to apply wool to the land and plough it."

50. *Bhowany Tahsildar's Report.*—"The plants, yerukalay, auvaray, pungay, peranday, kolinjy, and parappoodoo (a plant supposed to grow on rocks) are applied to nunjah (wet) salt lands, which are then cultivated."

51. "In some places the people procure manure and sweepings at little or no expense, which they apply to their lands."

52. "The practice of using milkhedge to the fields does not exist in this district as the people are unable to get it in quantities required."

53. "Salt punjah (dry) land is manured by the dung of cattle, herds of which are for the purpose collected on the land."

54. "The practice of collecting water in the field after ploughing it during the rainy season does not exist in this part of the district. It seems that this method should be applied only to the lands which are sloping, but if applied to the flat land the salt will not go out."

55. "The people do not take so much care about their salt lands after the fall of rain, but go with their ploughs to their better lands."

56. "In some places salt lands of all kinds are cultivated with hemp or flax, and the people say that the leaves of these plants serve as manure. But this practice does not seem to be extensive."

57. *Udumulpettah Tahsildar's Report.*—"On inquiring of the wet land cultivators about the mode by which they improve their salt lands to be fit for cultivation, it appears that, after ploughing those lands, they annually apply to them the plants peranday, kolinjy, and auvaray in bundles, tread them into the mire, and keep the land in this state till those plants are rotten. Then they plough the lands and sow paddy in them, which yield a pretty good return as the salt does not come up; but this will not wholly free the land from salt."

58. The plants and leaves generally applied for improving the salt land are the following :—

Auvaray = Cassia Auriculata.
Kolinjy = Galega.
Yerukalay = Asclepias gigantia.
Peranday = Cissus quadrangularis.
Poonga = Dalbergia Arborea or Pongamia glabra.
Patchan or Kally = Milkhedge.
Thoombai = Phobius Indica.

(Signed) A. WEDDERBURN,
Collector.

Market Prices.

59. The entire absence of trustworthy information, regarding the current rates prevailing at one time in different parts of this Presidency, for agricultural productions, is a serious drawback to the prosperity of the country. At present prices are liable to great fluctuations; a rise of thirty per cent. and a fall of a similar amount are far from unusual, and frequently for no sufficient reason; but not only do the prices at any given market fluctuate greatly, but those prevailing at that market and at another market situated at no great distance differ almost as widely. Before the extension of railways, canals, and good roads over the country, great fluctuations in prices and wide differences in those ranging at one time in different localities were only to be expected; but, now that the facilities are so much greater for the conveyance of agricultural produce over the country, we might reasonably expect that the prices would be more uniform and less liable to sudden and great changes.

60. Great fluctuations in prices are beneficial neither to the farmer nor to the consumer of his produce; as a rule they seldom arise directly from natural causes, but spring from the machinations of speculative middlemen, who are the chief gainers by unsteadiness of prices. Ryots seldom keep any agricultural produce on hand for any length of time; their surplus grain they generally sell soon after it is harvested, when it is bought up by these speculators, who utilize every opportunity for raising prices by keeping back produce, by circulating incorrect information regarding the prices prevailing in other districts, and by endeavoring to create undue apprehensions regarding the effects of floods or drought on growing crops, &c., &c.

61. Under present arrangements these middlemen are of much use to the country in keeping up something like an equilibrium between supply and demand; in their absence the Ryot would at one season overstock the retail market and at another leave it altogether unsupplied. But these middlemen have at present too much power, a power which would be much lessened if reliable current price lists were published by Government once a week for general information.

62. Something is now attempted in the way of providing Agricultural Price Lists for the Madras Presidency, but the monthly statements when printed are generally three months in arrears, and therefore are not of the least practical value to agriculture.

THE SYDAPET EXPERIMENTAL FARM.

Live Stock.

63. *Cattle.*—In June we imported the Aden cattle referred to in my last report. One of the cows died during the voyage; the remaining animals, consisting of one bull, one cow, and two

calves, reached Madras in safety, but were all much out of condition when landed. The cost of the stock in Aden was Rupees 208-14-0, and for their conveyance, &c., to Madras, the charge was Rupees 630-12-0, making the total outlay on account of this importation Rupees 839-10-0. These animals are not nearly so good as I had expected that they would be ; and, if they are fair specimens of the breed, which I have every reason to believe they are, the Aden breed has been much overpraised. I make this observation with reference to their form and their general quality only ; I have not yet had an opportunity of forming a conclusive opinion regarding the milk-producing capabilities of the cow, though, from the fact that she has reared her own calf along with the calf of the cow that died, she cannot be very inferior in this respect. Both the calves are bulls ; one, the calf of the cow that died, is much inferior in form and quality to the other. If the cow should prove to be a good milker, her defects in shape may be overlooked, for it must be remembered that there are several highly-valued breeds of dairy stock in Europe, the cows of which are exceedingly irregular in form. If, by the use of bulls of the Aden breed amongst the dairy stock of the Ryot, we can succeed in producing a cross the cows of which will possess larger milk-yielding capabilities, the experiment will have been fairly successful, and the improvement in form may be attempted by the use of bulls of some other breed.

64. The services of the bulls on the Experimental Farm are now free, the small fee formerly charged being dispensed with. I made this change as I found that the fee tended to keep Ryots from sending cows to the bulls. The result has been satisfactory in the services of the bulls being in greater request than when a fee was exacted, and the amount annually collected from fees was always an exceedingly small sum. The services of the Aden bull have not been in such demand as I had anticipated, but this may be because the breed is as yet but little known to Ryots. In size and in weight the bull is well fitted for use amongst the cows of the district.

65. In my report for 1872 I gave some statistics showing the quantity of milk yielded by a Nellore cow during a period extending over twelve weeks. I have now much pleasure in being able to quote similar statistics regarding another cow (the produce of a cross between a Devon bull and a Nellore cow) ; the results of the experiment have been kindly placed at my disposal ; they have been collected with great care, and are thoroughly reliable. The registrations began from the third day after the cow calved (her third calf) and extended over a period of six months. During the whole of this time the daily food of the cow consisted of green fodder 40 lbs., ground-nut cake 4 lbs., and wheat bran 2 lbs., and about a dessert spoon of salt ; the ground-nut cake was steeped and mixed with the bran, half being given in the morning and half in the evening ; the cow was kept tied in the byre except for about two hours daily, when she was let out for exercise and to be washed ; she was milked at about seven in the morning and at five in the evening. While the cow was being milked the calf was always tied near her in the usual way, and was allowed to strip the udder, a sufficiency of milk being left for the wants of the calf. The following are the registrations :—

—	Morning.		Evening.		Total.			—	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINTS.		MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINTS.
1st day ...	3	2	2	6	6	0		43rd day ...	2	7	2	3	5	2	
2nd ,, ...	3	2	2	7	6	1		44th ,, ...	2	7	2	4	5	3	
3rd ,, ...	3	3	2	7	6	2		45th ,, ...	2	4	2	2	4	6	
4th ,, ...	3	4	2	6	6	2		46th ,, ...	1	6	1	3	3	1	
5th ,, ...	3	7	3	1	7	0		47th ,, ...	2	2½	2	0	4	2½	
6th ,, ...	3	7	3	0	6	7		48th ,, ...	2	2	1	7	4	1	
7th ,, ...	4	4	3	0	7	4		49th ,, ...	1	3	2	1	3	4	
1st week ...	25	5	20	3	46	0	138	7th week ...	15	7½	14	4	30	3½	91
8th day ...	3	6	3	0	6	6		50th day ...	2	5	2	1½	4	6½	
9th ,, ...	4	0	3	0	7	0		51st ,, ...	2	4	2	2	4	6	
10th ,, ...	3	6	2	4½	6	2½		52nd ,, ...	2	2	2	0	4	2	
11th ,, ...	3	6	2	6½	6	4½		53rd ,, ...	2	4	2	1	4	5	
12th ,, ...	3	2½	2	7	6	1½		54th ,, ...	2	4	2	0	4	4	
13th ,, ...	3	5	2	2½	5	7½		55th ,, ...	2	½	2	0	4	½	
14th ,, ...	3	0	2	7	5	7		56th ,, ...	2	4	1	7	4	3	
2nd week ...	25	1½	19	3½	44	5	134	8th week ...	16	7½	14	3½	31	3	94
15th day ...	3	3	2	1½	5	4½		57th ,, ...	2	4	2	1	4	5	
16th ,, ...	3	4	2	7	6	3		58th ,, ...	2	3	2	1	4	4	
17th ,, ...	3	5	2	4	6	1		59th ,, ...	2	4	2	½	4	4½	
18th ,, ...	3	4	2	3	5	7		60th ,, ...	2	4	2	0	4	4	
19th ,, ...	3	5	2	3	6	0		61st ,, ...	2	4	2	0	4	4	
20th ,, ...	3	5	2	3	6	0		62nd ,, ...	2	1	1	7	4	0	
21st ,, ...	3	4	2	3½	5	7½		63rd ,, ...	2	4	2	2	4	6	
3rd week ...	24	6	17	1	41	7	126	9th week ...	17	0	14	3½	31	3½	94
22nd day ...	3	2	2	4	5	6		64th day ...	2	3	2	1	4	4	
23rd ,, ...	3	5	2	4	6	1		65th ,, ...	2	2	2	0	4	2	
24th ,, ...	3	4	2	5	6	1		66th ,, ...	2	3	2	1	4	4	
25th ,, ...	3	2½	2	5	5	7½		67th ,, ...	2	2	2	1½	4	3½	
26th ,, ...	3	2½	2	6	6	½		68th ,, ...	2	2½	2	0	4	2½	
27th ,, ...	3	2	2	7½	6	1½		69th ,, ...	2	1	2	0	4	1	
28th ,, ...	3	4	2	6	6	2		70th ,, ...	2	1	2	1	4	2	
4th week ...	23	6	18	5½	42	3½	127	10th week ...	15	6½	14	4½	30	3	91
29th day ...	3	3	2	5	6	0		71st day ...	2	4	2	1	4	5	
30th ,, ...	3	6	2	6½	6	4½		72nd ,, ...	2	2	2	0	4	2	
31st ,, ...	3	6	2	6	6	4		73rd ,, ...	2	3	2	0	4	3	
32nd ,, ...	3	6	3	0	6	6		74th ,, ...	2	0	2	1	4	1	
33rd ,, ...	3	2	3	0	6	2		75th ,, ...	2	4	2	1½	4	5½	
34th ,, ...	3	5½	2	7	6	4½		76th ,, ...	2	0	2	0	4	0	
35th ,, ...	3	5	2	6	6	3		77th ,, ...	2	1	1	7	4	0	
5th week ...	25	1½	19	6½	45	0	135	11th week ...	15	6	14	2½	30	½	90
36th day ...	3	5	2	6	6	3		78th ,, ...	2	0	1	7	3	7	
37th ,, ...	3	5	2	6	6	3		79th ,, ...	2	1	1	6	3	7	
38th ,, ...	3	3½	2	4	5	7½		80th ,, ...	2	½	1	7	3	7½	
39th ,, ...	3	3½	2	4	5	7½		81st ,, ...	2	½	1	6	3	6½	
40th ,, ...	3	0	2	3	5	3		82nd ,, ...	2	½	1	7	3	7½	
41st ,, ...	3	0	2	2	5	2		83rd ,, ...	2	5	1	7	4	4	
42nd ,, ...	3	1	1	6	4	7		84th ,, ...	2	4½	1	7	4	3½	
6th week ...	23	2	16	7	40	1	120	12th week ...	15	4	12	7	28	3	85

——	Morning.		Evening.		Total.			——	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINTS.		MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS	PINTS.
85th day ...	2	5	2	0	4	5		127th day...	2	3	2	1	4	4	
86th ,, ...	2	6	2	1	4	7		128th ,, ...	2	3	2	1	4	4	
87th ,, ...	2	5	2	½	4	5½		129th ,, ...	2	4	2	½	4	4½	
88th ,, ...	2	6	2	1	4	7		130th ,, ...	2	3	2	1	4	4	
89th ,, ...	2	6	2	1	4	7		131st ,, ...	2	3	2	1	4	4	
90th ,, ...	2	5	2	1	4	6		132nd ,, ...	2	3	2	1	4	4	
91st ,, ...	2	4½	2	0	4	4½		133rd ,, ...	2	3	2	1	4	4	
13th week ...	18	5½	14	4½	33	2	100	19th week ...	16	6	14	6½	31	4½	95
92nd day ...	2	4	2	½	4	4½		134th day...	2	2	2	0	4	2	
93rd ,, ...	2	3	2	1	4	4		135th ,, ...	2	2	2	0	4	2	
94th ,, ...	2	4	2	1	4	5		136th ,, ...	2	2	2	1	4	3	
95th ,, ...	2	4	2	½	4	4½		137th ,, ...	2	2	2	0	4	2	
96th ,, ...	2	4	2	1	4	5		138th ,, ...	2	2	2	0	4	2	
97th ,, ...	2	4	2	0	4	4		139th ,, ...	2	2	2	0	4	2	
98th ,, ...	2	5	2	1	4	6		140th ,, ...	2	2	1	7½	4	1½	
14th week ...	17	4	14	5	32	1	96	20th week ...	15	6	14	½	29	6½	89
99th day ...	2	5	2	1	4	6		141st day...	2	0	2	0	4	0	
100th ,, ...	2	5	2	0	4	5		142nd ,, ...	2	1	2	0	4	1	
101st ,, ...	2	1	2	0	4	1		143rd ,, ...	2	1	2	0	4	1	
102nd ,, ...	2	2	2	1	4	3		144th ,, ...	2	1	2	0	4	1	
103rd ,, ...	2	½	2	½	4	1		145th ,, ...	2	0	2	0	4	0	
104th ,, ...	2	1	2	1	4	2		146th ,, ...	2	0	2	0	4	0	
105th ,, ...	2	2	2	1½	4	3½		147th ,, ...	2	1	2	0	4	1	
15th week ...	16	½	14	5	30	5½	92	21st week ...	14	4	14	0	28	4	86
106th day ...	2	3	2	1	4	4		148th day...	2	1	2	0	4	1	
107th ,, ...	2	1½	2	1	4	2½		149th ,, ...	2	1	2	0	4	1	
108th ,, ...	2	2	2	½	4	2½		150th ,, ...	2	1	1	7	4	0	
109th ,, ...	2	1½	2	0	4	1½		151st ,, ...	2	1	1	6	3	7	
110th ,, ...	2	3	2	0	4	3		152nd ,, ...	2	1	1	6	3	7	
111th ,, ...	2	3	2	½	4	3½		153rd ,, ...	2	0	1	6	3	6	
112th ,, ...	2	3	2	0	4	3		154th ,, ...	1	7	1	6	3	5	
16th week ...	16	1	14	3	30	4	92	22nd week ...	14	4	12	7	27	3	82
113th day ...	2	2	2	1	4	3		155th day...	2	0	1	7	3	7	
114th ,, ...	2	3	2	1	4	4		156th ,, ...	2	1	1	6	3	7	
115th ,, ...	2	3	2	0	4	3		157th ,, ...	2	1	1	6	3	7	
116th ,, ...	2	3	2	1	4	4		158th ,, ...	1	0	1	6	2	6	
117th ,, ...	2	3	2	0	4	3		159th ,, ...	2	2	1	6	4	0	
118th ,, ...	2	3	2	1½	4	4½		160th ,, ...	2	1	1	6	3	7	
119th ,, ...	2	3	2	0	4	3		161st ,, ...	2	0	1	6	3	6	
17th week ...	16	4	14	4½	31	½	93	23rd week ...	13	5	12	3	26	0	78
120th day ...	2	2	2	1	4	3		162nd day...	1	7	1	6	3	5	
121st ,, ...	2	3	2	0	4	3		163rd ,, ...	2	2	1	5	3	7	
122nd ,, ...	2	2	2	1	4	3		164th ,, ...	2	1	1	5	3	6	
123rd ,, ...	2	3	2	½	4	3½		165th ,, ...	2	1	1	5	3	6	
124th ,, ...	2	2	2	1	4	3		166th ,, ...	2	0	1	6	3	6	
125th ,, ...	2	3	2	1	4	4		167th ,, ...	2	0	1	4	3	4	
126th ,, ...	2	3	2	½	4	3½		168th ,, ...	2	0	1	5	3	5	
18th week ...	16	2	14	5	30	7	93	24th week ...	14	3	11	4	25	7	78

In these records a measure is calculated to be equal to three imperial pints ; fractions of a pint are omitted unless over a half, which is calculated as one pint ; the exact contents of a standard measure is 104 cubic inches, while an imperial pint contains 34·659 cubic inches.

66. The following statement exhibits the quantity of milk yielded by the cow in each of the months over which the experiment extended :—

	MRS.	OLKS.	PINTS.		MRS.	OLKS.	PINTS.
1st week	46	0	138	13th week...	33	2	100
2nd ,, ...	44	5	134	14th ,, ...	32	1	96
3rd ,, ...	41	7	126	15th ,, ...	30	5½	92
4th ,, ...	42	3½	127	16th ,, ...	30	4	92
Yield in 1st month ...	174	7½	525	Yield in 4th month ...	126	4½	380
5th week	45	0	135	17th week...	31	½	93
6th ,, ...	40	1	120	18th ,, ...	30	7	93
7th ,, ...	30	3½	91	19th ,, ...	31	4½	95
8th ,, ...	31	3	94	20th ,, ...	29	6½	89
Yield in 2nd month ...	146	7½	440	Yield in 5th month ...	123	2½	370
9th week	31	3½	94	21st week...	28	4	86
10th ,, ...	30	3	91	22nd ,, ...	27	3	82
11th ,, ...	30	½	90	23rd ,, ...	26	0	78
12th ,, ...	28	3	85	24th ,, ...	25	7	78
Yield in 3rd month ...	120	2	360	Yield in 6th month ...	107	6	324

67. The total quantity of milk yielded during the six months was 799 measures and 6 ollocks or 2,399 imperial pints. The prices paid for the food, &c., of the cow during the experiment were as follows:—ground-nut cake 65 lbs. per rupee, bran 32 lbs. per rupee, green fodder 300 lbs. per rupee, straw for bedding, salt, &c., 1 rupee per month, and attendance Rupees 3 per month (the man having other duties to perform). The total cost incurred during the six months was—

	RS.	A.	P.
168 days, green fodder at 40 lbs. daily	22	6	5
168 ,, ground-nut cake at 4 lbs. daily	10	5	5
168 ,, bran at 2 lbs. daily	10	8	0
Straw and salt	6	0	0
Attendance	18	0	0
Total...	67	3	10

If from this amount we deduct Rupees 15, the value of the calf at six months old, there remains Rupees 52-3-10 as the cost of the 799 measures and 6 ollocks of milk or, say, in round numbers, 800 measures for Rupees 52 equal to one anna per measure ; it should, however, be remembered that the yield of milk will gradually continue to diminish until the cow again calves, and, as the cost of maintaining the cow up to that period will not be less than when in full milk, the cost of the milk will be proportionally increased, but throughout the year the milk will not cost 2 annas per measure. As in the larger towns of Southern India, milk of very inferior quality sells readily for 3 annas per measure ; it will be seen that in dairying a *very* profitable business could be established, and one well worthy of the attention of the "Poor Whites" of this country, regarding whom of late we have heard so much. But a dairy to be successful must command the confidence of the public.

68. It will be observed that the return for the 7th week is 25 per cent. less than the yield of the previous week ; this sudden diminution was due to the cow having been milked by a person

to whom she was unaccustomed, the man who always milked her being absent from sickness ; this change proved very unfortunate, for though, when the regular milker returned to his duties in the 13th week, the yield somewhat improved, it was still very much below what it would have been had the change referred to not occurred. I think it necessary to call particular attention to the facts just stated, for, though some cows will give the same quantity of milk to any milker, it is well that it should be known that with some cows a change in their attendant may lead to a very large reduction in the quantity of milk obtained.

69. During the first four months of the experiment the calf was allowed to take daily about one measure of milk, and about half a measure daily during the other two months ; this milk was, of course not brought to account in the foregoing registrations ; I think it an advantage in this country to allow the calf access to its mother before and after milking as is customary in this part of India, not only does the cow yield her milk more freely, but what is of more importance her udder is thoroughly stripped after each milking ; and, with the help of other food the calf can be reared at a very moderate cost. The first calf of the cow referred to was reared in this manner until about a-year old, when it was fed on food similar to that given to its mother ; it was always in good condition, and will calve at three years old, fully a year earlier than it is usual for heifers to calve in this country.

70. I attach very great importance to this experiment ; there is not, as far as I am aware, any published record of any similar experiment made in this country excepting that detailed in my report for 1872 ; and, before we can attempt to do anything to improve the dairy stock of the country, which so greatly needs attention, we must have reliable data for the guidance of our efforts.

71. *Sheep.*—I regret exceedingly to state that the opinion I expressed in my last report regarding the probable effects of the Madras climate on the health of the sheep imported from China has proved correct. At the close of the year the only sheep left of this breed were one ram, one ram lamb, and two gimmer lambs, and I fear that neither of the rams will be of any use. Great care was taken of the sheep, but they never throve in a satisfactory way after the commencement of the hot season.

72. The result of the experiment is unfortunate, as the breed possesses many valuable qualities, some of which, it is desirable, should be stamped on the sheep of Southern India ; amongst these characteristics are great length and depth of frame and ribs remarkably well arched, a fair yield of wool—very fine and lustrous—and great prolificness in the ewes.

73. It will be observed that all the sheep imported have died with the exception of one ram. Two of the ewes were in lamb when they arrived in Madras ; one of these a month afterwards gave birth to three lambs, but died on the day following, when it was ascertained that there was a dead lamb in the womb ; the other ewe shortly afterwards produced two fine lambs. It is a rare occurrence for ewes of the indigenous breeds found in Southern India to give birth to more than one lamb at a time ; though the Sydapet flock has in some years contained as many as 150 ewes, I have never, in a single lambing season, known more than two or three cases to occur of births of twins. As I have before had occasion to observe, it is very undesirable that anything should be done to increase indiscriminately the prolificness of the ewes kept by Ryots in Southern India until some better means are in existence for providing the ewes with food until their lambs are able to take care of themselves ; under usual circumstances it is now in most districts, in ordinary seasons, as much as the ewes can do to secure food for their own support, their single lambs, from unsuitable and insufficient food, growing up into animals that seldom pay for the food they consume when put up to fatten for the butcher. But if it is undesirable to increase indiscriminately the lamb-producing abilities of our ewes, there is no reason why this improvement should not be attempted with sheep in a few favored localities, and I would strongly recommend a further importation of Chinese sheep for use in experiments in such districts.

74. There is, I fear, now but little probability that we will be able to meet with a breed of sheep suited for use in improving the Sydapet breed, for all the breeds with which I am acquainted that possess superior qualities such as it is desirable to stamp on the Sydapet breed are quite unable to withstand the ill effects of the Madras climate, and it would be exceedingly unfortunate if, in attempting to add any new quality to those possessed by sheep of the Sydapet breed, they should be rendered less hardy and less able to encounter the effects of a high temperature.

75. The following details regarding the management of the Sydapet flock will supply the information for which I am frequently asked. All rams are kept entirely separate from the ewes; after being weaned, the ram lambs are reared in pens and are only occasionally allowed to graze; their food consists of green fodder and ground-nut cake. I should much prefer that these sheep should be grazed more frequently instead of them being so much confined in pens, but it is so extremely difficult to keep the rams apart from the ewes when both flocks are grazing, however I intend forming a grass paddock wherein the rams can be secured and in which they can obtain food and regular exercise during certain hours of each day. The rams are not used until they are about two and-a-half years old, at which age a good specimen will weigh from 100 to 120 lbs. live weight. The ewe flock is generally sorted over once a-year, and those of a bad form or color or with inferior wool, as well as those that have lost some of their teeth, are taken out of the flock and put aside for fattening. In September the ewes that remain in the flock are, with a number of gimmers then about eighteen months old, put to the ram; about forty ewes are placed with one ram the breast of which is colored to mark the ewes in a way that enables the shepherd to detect readily those ewes that have been served, which he removes from the flock. The lambs are born about five months after, generally about 90 per cent. of the ewes proving in lamb. The ewes when about to lamb are placed in pens, three or four in each, where they are kept until their lambs are about three weeks old, after which they are again put into the flock in the sheepfold. All males that do not promise to turn out well are, when about six weeks old, made into wethers. When about three months old the lambs are removed from their mothers and are weaned, about a fortnight's separation sufficing for this, after which the wether and gimmer lambs are grazed in the flock with the ewes, the ram lambs being placed by themselves as previously noticed. All the sheep are generally clipped in April, which, I find, is the best month in the year for the purpose. When the ewes are being clipped, it is usual to mark the lambs in a way to render their identification easy; in the farm flock this is done by cutting a small hole by means of an ear-pincer in the cartilage of one ear of each. During the season of the year when night dews are heavy the sheep do not leave the fold in the morning until the sun has removed the greatest part of the dew; it was found when the sheep were turned out too early in the morning to feed upon grass heavily covered by dew that a number of them were invariably attacked by dysentery of a severe type. During the hottest part of the day the sheep return to the fold for a few hours, and again go to graze until about five in the evening, when they again return and receive about half a pound of ground-nut cake per head, and are shut up in the fold for the night. During very dry weather they receive, in addition to the cake, a small quantity of green food, but they are maintained chifley by the food they gather when out grazing. The sheep thus fed are kept in a thriving condition; they are, of course, not fit for the butcher, but they are generally in the condition that it is most desirable for breeding stock to be. I have tried various months in the year in which to put the ewes with the ram. Under the impression that lambs born in December would thrive best from the abundant grass at that season available, I put the ewes with the ram in July, but the result of the experiment was disastrous, as a very large proportion of the lambs died, evidently, I think, from their mother's milk being unfitted for them, the result of the too liberal consumption of immature hastily-grown grass. Next year the lambing season was postponed a fortnight, and the result was fewer deaths amongst the lambs. From this time the lambing season was each year made later until it fell in the middle of February, at which time of year it

was found that fewest deaths occurred amongst the lambs, the death-rate having sunk from at the least 20 per cent. down to at the outside 5 per cent. This experience may be useful to owners of flocks; it was only recently that I was consulted regarding the management of a flock the lambs of which every lambing season died in great numbers; on inquiry, I was informed that each year's lambs generally fell about a month after the close of the monsoon rains, and to this fact I attributed the great mortality. Whenever ewes are suckling their lambs, and are feeding on the hastily-grown grass produced by the monsoon, loss amongst the lambs will be inevitable; I am convinced that the only way to avoid great mortality amongst lambs in Southern India is to arrange for their birth to occur after the sun has had time to harden the monsoon grass, and remove its pernicious qualities.

76. *Pigs.*—In my last report I referred to some Chinese pigs that had recently been received at this farm. Though every care was taken of them they never thrived, and have all died with the exception of one boar, which will not, I think, long survive the others, it is now in such a very feeble state of health. Besides this, there were at the close of the year four young pure-bred Chinese pigs, and a sow of the farm breed, which was served by the Chinese boar, is shortly expected to litter. It will thus be seen that the experiment, as far as it has yet proceeded, does not promise to yield very encouraging results; however, should it so happen that all the pure-bred animals should die, which is not improbable judging from our recent experience, we will, I think, make sure of some good resulting from the importation, in the half-bred pigs shortly expected. These Chinese pigs were not imported in order that they might be maintained as a pure breed; the intention was to cross them with the breed already at the farm in order that this breed might be stamped with some of the qualities which the Chinese breed possesses.

77. The pigs we imported from China were not of the quality I had anticipated from reading the eulogiums passed on the breed by English agriculturists, who wrote in the beginning of the present century, when the Chinese pig was attracting so much attention in England; and, if the pigs received are fair representatives of the breed now found in China, the English pig-breeders are now far in advance of the Chinese in the quality of the animals they now raise.

78. The Chinese have long devoted much care to the breeding and rearing of pigs, pork forming so large a proportion of the food of these people. It is said that Chinese pigs are very prolific, that they fatten rapidly on a very moderate allowance of food, and that their flesh is excellent, but they are not considered a hardy breed.

79. It may not be generally known that most of the best breeds of pigs now found in England and in France owe many of their most valuable qualities to the Chinese pig, which about 70 or 80 years ago was imported largely into England and France, and used for improving the indigenous breeds which were then very coarse and inferior, and widely different in every way to the pigs now found in these countries.

80. *Poultry.*—Arrangements have been made for procuring from Sydney a number of poultry of the best English breeds consisting of Brahma and Dorking fowls and Aylesbury ducks. When these arrive in Madras, they will be sent to this Farm, where they will be kept for raising stock for distribution over the country in view to improve the indigenous breeds of poultry.

81. Heretofore, with the exception of the birds of the Brahma-Dorking breed which were given to the people of the Wudder Settlement at Sydapet, it has been usual to charge the full value for all poultry obtained from this farm, but I trust that it will be found possible to extend largely the practice followed in the case of the Wudders and to distribute male birds of improved breeds gratuitously to the headmen of villages under certain conditions. I believe that in this way a great amount of good can be done at a very moderate cost; it is true that in many localities from the absence of natural food during a considerable period in the year, and the neglect of the people in providing proper food, superior breeds of poultry would degenerate, but there are

many localities in which natural food is abundant throughout the greater part of the year that might be selected for the experiments I have suggested.

82. I sent to Sydney for the poultry, because the former lot I received from there, proved so very satisfactory; I have not made any experiments in getting out poultry direct from England, but I am acquainted with the results of many such experiments from which it appears that there is generally a great loss of life during transit from England, and that the birds which survive the voyage are seldom able to encounter the great heat of the Madras climate.

83. The *American Agriculturist* of September last drew attention to some ducks which had just been landed in New York of a breed that had previously been unknown in America or Europe. These ducks had been brought from Shanghai, where they had been hatched from eggs obtained in the city of Pekin. The account stated that from their size the ducks were in appearance very like small geese; it stated that they were very uniform in size, and that a pair, only four months old, weighed 12 lbs. From this description, I was induced to enter into correspondence with Messrs. Arbuthnot and Co. of Madras in view to obtaining some specimens of this apparently valuable breed; these gentlemen very kindly arranged with Messrs. Matheson, Jardine and Co., of Hong Kong, to procure in Pekin and send to Madras a number of pairs of these ducks; if these prove to be at all equal to the description given of the breed in the American Newspaper, the ducks will be a valuable introduction here. Our indigenous breeds are very poor, while the facilities for rearing ducks are great in most parts of the Presidency.

Crops.

84. *Field experiments.*—Several series of experiments with manures of different kinds, applied in different quantities, were commenced at the beginning of the last cultivating season; but, owing to the absence of seasonable rains after the crops were sown, most of these experiments had to be abandoned, and the crops that were partially successful were valueless in affording information regarding the comparative values of the manures used; these results were especially unfortunate, seeing that in the previous year the weather was also unpropitious for field experiments. It is highly desirable that we should devote great attention to field experiments; there is so much to be learned regarding the peculiarities of the various crops we grow, and the effect on them of dressings in various proportions of the different manures available in Southern India. Not only are these experiments very costly in the amount of labor and supervision they absorb, but as they must be made at the season of the year, when the ordinary cropping of the Farm requires all the attention and labor that can be devoted to it, they are exceedingly troublesome; however, I should not grudge the expenditure these experiments cause of time and money, if we could but insure that even a very small proportion of them would meet with the conditions necessary to give a practical value to the information they yield. It is very discouraging to see so much labor wasted when a drought causes an experiment to be abandoned.

85. At present on the Experimental Farm, owing to the absence of means for irrigating the land, we have no alternative but to begin our field experiments shortly before the time the rains of the north-east monsoon are due, when the weather is always very irregular and uncertain. Of course, field experiments never can be conducted with that scientific exactitude that is desirable, but the conditions under which they are placed should as far as possible be under control; and to obtain this, it is necessary that they should be instituted at the season of the year when the weather may be expected to be calm or somewhat uniform in character. I have found at Sydapet that only one out of every two or three monsoon seasons is at all favorable for the carrying out of comparative experiments in the field with different manures. The best time at which to begin such experiments would be about the middle of November, when in an ordinary season the heaviest burst of the monsoon will be over; there are, however, but few of our crops, that when sown so late would reach maturity unless irrigated, and this unfortunately we cannot do except on a very limited scale. It is very desirable that the channel to be made for supplying the Sydapet Farms with irrigation

water should be made with the least possible delay, not only that the field experiments may be conducted with more certainty of their reaching completion, but also to afford the means for carrying out the many field experiments that must be instituted for educational purposes on the Establishment of the School of Agriculture.

86. *Seed-sowing.*—The following experiment was made in order to ascertain the most suitable depth at which to sow maize and cotton. Fifty grains of each kind of seed were carefully sown at depths varying from 1 inch, to 5 inches. The soil was kept in a moist condition during the time the experiment was proceeding :—

New Orleans Cotton.

When counted.	Sown 1 inch deep.	Sown 2 inches deep.	Sown 3 inches deep.	Sown 4 inches deep.	Sown 5 inches deep.
	Number of plants that appeared above ground.				
1st day... ...	...	...	...	...	...
2nd ,, ...	...	...	...	...	...
3rd ,, ...	...	...	...	...	...
4th ,, ...	...	...	...	...	...
5th ,, ...	15	...	...	...	...
6th ,, ...	32	8	1	...	...
7th ,, ...	33	12	5	...	...
8th ,, ...	33	17	8	...	...
9th ,, ...	33	17	8	...	...

The seeds sown at 1 inch in depth produced 33 plants, or 66 plants for each 100 seeds, and the whole of these plants had appeared before the close of the seventh day after sowing ; the seeds sown at 2 inches gave a return of only 34 plants for each 100 seeds ; and the whole of these plants did not appear until the eighth day after sowing. The seeds deposited at 3 inches in depth produced only 16 plants for each 100 seeds, and these were not all above ground until the eighth day. It will be seen that no plants were produced from the seeds sown at 4 inches and at 5 inches.

Maize.

When counted.	Sown 1 inch deep.	Sown 2 inches deep.	Sown 3 inches deep.	Sown 4 inches deep.	Sown 5 inches deep.
	Number of plants that appeared above ground.				
1st day... ...	...	...	...	...	...
2nd ,, ...	...	...	...	...	...
3rd ,, ...	...	...	...	...	...
4th ,, ...	...	...	...	...	...
5th ,, ...	10	...	...	...	...
6th ,, ...	27	4	...	...	...
7th ,, ...	38	6	...	...	...
8th ,, ...	39	13	4	...	...
9th ,, ...	40	16	9	...	...

The 50 grains of maize sown at 1 inch produced 40 plants. The same quantity of seed sown at 2 inches produced only 16 plants ; a similar quantity sown at 3 inches in depth yielded only 13 plants. It will be observed that the maize plants, like the cotton appeared much more quickly when the seed was lightly covered by soil.

87. From these experiments it would appear that shallow-sown seeds of the kinds experimented with not only germinate much more quickly, but produce a great many more plants than seed that is buried more deeply in the soil; but it must not be inferred from this that shallow sowing is more likely to produce good results than deep sowing, for the information above given is only a portion of that the experiment is expected to yield; we have yet to ascertain whether the more rapid first growth of the plants produced from shallow-sown grain is supported by an equally-luxuriant root-growth upon which the ability of the plant to withstand the illeffects of a long drought so greatly depends. I am inclined to think that with such large seeds as maize and cotton, 1 inch is too shallow a depth at which to sow them, and, in practice, I seldom sow these seeds at less than 2 inches in depth; but then this is only upon deeply-cultivated and well-pulverised soil, whereas the soil used in the experiment resembled in its physical condition the soils of the Ryot. I believe that the more deeply the seed can be sown in the soil with due regard to its germinative powers the more certain will the plants produced from it reach maturity; but to ensure the proper germination of deeply-sown seed, it is absolutely necessary that the soil in which it is sown should be in a high state of cultivation in order to admit of rain water filtering freely through it, and in its way carrying down atmospheric air to the buried seed. It must be remembered that germination cannot take place except under the influence of air, heat, and moisture; seed that is too deeply buried in a close badly-cultivated soil will altogether fail to germinate. The experiment, as far as it has proceeded, shows how important it is, in order to secure a uniform growth of young plants, that the seed should be doposited at a uniform depth in the soil. I need scarcely point out how necessary it is, in order to secure the best results at harvest from every individual plant, that we should, as far as possible, bring all the plants in a crop to maturity at one time, which can be secured only by regular sowing. Badly or unevenly sown seed must, as the experiment shows, produce plants of great unevenness in growth, these at harvest will mature at very different times, leaving the Farmer no choice but either to wait for the backward plants, and thus lose seed by the shedding of the too ripened grain, or, cut down the whole when the first plants reach maturity, and sacrifice the produce of those not yet matured. I hope in my next report to be able to state the further results of the experiment just noticed.

88. *Carolina Rice.*—The following particulars, respecting two samples of country-raised Carolina rice, which Messrs. Walker and Co. of Madras very kindly forwarded to England on my behalf, may possess some interest.

89. Parcel A was prepared from 8 Madras measures of Carolina paddy and consisted of 3¾ Madras-measures of clean rice. Messrs. Walker and Co. were good enough to have the paddy husked in the same way that it is usual in Madras to husk all paddy intended for export to England The 8 measures of paddy yielded as follows:—

	By volume. Per cent.
Clean rice fit for the Home Market	46·87
Broken rice	3·13
Husk and wastage	50·00
	100·

With reference to this result, Messrs. Walker and Co., wrote to me: "We are not very well satisfied as to the result of the husking, the grains are more broken than is desirable, but the coolies say they found it more difficult to husk the paddy than the ordinary native grain." With reference to the cost of husking, they wrote: "The cost of husking the 8 measures is 1 anna, and we can contract at this rate for all you intend sending to England. In the same letter they remarked, "the wastage on this 8 measures may be taken as a fair average."

90. Parcel (B) consisted of 623 pounds of cleaned rice prepared from 448 Madras measures of country-raised Carolina paddy. In addition to the clean rice there were 21¼ measures of broken rice, the value of which was in Madras one anna per measure.

91. The following letter refers to parcel B :—

Dear Sir,

We now wait on you with our Broker's report and valuation on the four bags of rice sent to London on your account by S. S. *Sultan*, and we trust the report will be considered satisfactory. We may mention that while your rice is valued at 10*s*. 4½*d*. to 10*s*. 6*d*. per cwt., *ordinary* "Pinky" was sold at 9*s*. 6*d* to 10*s*. 7½*d*. for *good*.

(Signed) WALKER, AND CO.,

Broker's report on four bags

of rice per *Sultan*.

"The rice proves to be very fine white grain, and, in quantity, would command 10*s*. 4½*d* to 10*s*. 6*d* ; it is different from what is known as "Pinky," and we doubt if the Starch-makers, who are the largest consumers of this particular sort, would like it so well ; but for cleaning purposes, it would meet a ready sale."

92. The rice was sold in London in the usual way ; the price realized, 11*s*. 6*d*. per cwt., was only a trifle higher than the price ruling at the time for ordinary Madras rice. This result was somewhat disappointing ; judging from the value generally put upon Carolina rice in London, I had anticipated a much larger price than was obtained.

93. It is, I think, probable that the very high price that Carolina rice, imported from America, commands in England is due chiefly to the very superior way in which it is prepared for market. The Madras grown Carolina paddy, from which the rice (Parcel B.) was prepared, was, as far as I can judge, quite equal in quality to the Carolina paddy which was imported into this country from America, and which was the seed from which the paddy in question was raised. I cannot offer any opinion as regards the appearance of the sample of the Madras prepared Carolina rice, in comparison with the appearance of the rice prepared under the milling processes usually followed in America ; but I can readily believe, from what I know of the processes followed in this country and in America in preparing rice for market, that the appearance of the American rice must be very greatly superior to the appearance of that prepared in Madras. In Madras, the husk merely is removed ; there is no attempt to remove the dark-colored surface which is found immediately beneath, and very little is attempted in the way of sizing the grain ; the whole process, such as it is, being performed by women by means of a pestle and mortar and a bamboo sieve. The following extract from a report published by the Department of Agriculture in the United States of America shows the process under which the Carolina rice of that country is prepared :—

"The rough rice is first ground between very heavy stones running at a high speed, which partially removes the rough integument or hull chaff. This chaff is passed out of the building by spouts, and the grain by similar means conveyed into the mortars, where it is beat or pounded for a certain length of time by the alternate rising and falling of very heavy pestles shod with iron. These are operated by a revolving cylinder of huge dimensions armed with powerful levers, which passing into a long opening in the pestle, about 15 feet in length, raise it in mid-air and let it fall suddenly into the great mortars below. From the mortars elevators take the rice to the fans, which separate the grain from the debris. From thence it goes through other fans that divide it into three qualities, known as "whole," "middling," and "small rice." The grain is lastly passed through a polishing screen lined with gauze wire and sheep-skins, which, revolving vertically at the greatest possible velocity, embellishes it with that pearly whiteness in which it appears in commerce." I need scarcely

remark that this great nicety in the preparation adds nothing to the food-value of the rice. Indeed, I believe that in the attempt to get a very white-colored rice, a large quantity of valuable human food is lost, as the portion of the seed immediately below the husk or outer skin contains the largest proportion of nutritious matters. It may be well enough to prepare rice for the London market in the way it is usually prepared in America; in England, there is always a demand at high prices amongst the luxurious and wealthy for produce either exceptionally good or exceptionally well prepared, and as rice forms but an exceedingly small proportion of the food eaten by Englishmen, the loss of nutritive matters by the unnecessary refinement of the process under which the rice is prepared is of little moment. The case is widely different in a country like this, with a people subsisting so largely on rice; in their case the loss of even a very small quantity of nitrogenized matter by a greater refinement in the preparation of their rice would be a very serious loss indeed. In England, the intrinsic value of rice as human food enters but little into the commercial value set upon it; the points of excellence specially demanded are, uniformity in size and color which must be a pearly white, matters of but small importance to rice-consumers in this country. If these views are correct, there is at present not much to induce the Cultivators of this country to grow Carolina paddy on an extensive scale for the Home market, for, not only must they produce a first-class sample of paddy, but there must be at work the agencies required to convert that paddy into the superior quality of rice required. In its superior productiveness, its superior quality, its less aquatic habits and other qualities to which I have alluded in former reports, Carolina paddy possesses many advantages over our indigenous varieties of paddy; but, I fear, it is hopeless to expect to secure from Madras raised Carolina rice the high price that American raised Carolina rice commands in London, until we can prepare rice for market in a way equally as good.

94. *Wheat.*—Several small plots were sown with wheat; some with seed obtained from the Neilgherries, and others with seed produced in the Coimbatore District; the sowings were made at different dates, between the 1st of January and the middle of March. The seed from both districts germinated well, and produced vigorous and healthy plants; however, only a very small proportion of them succeeded in maturing any grain, the result evidently of the high temperature that prevailed during the latter half of their growth. I think that, had the sowings been made not later than the middle of November, in order to secure the harvest in January, the result would have been very different. The plants up to the time they began to flower were very healthy and strong. The experimental plots were all thoroughly cultivated and liberally manured, and irrigation water was applied when necessary. I intend to make further experiments with wheat on the Sydapet Farms, if we are successful in meeting with a variety that can be grown generally over the plains of Southern India, wheat cultivation might be considerably extended. An average crop of wheat will yield a much larger quantity of human food than an average crop of paddy, while a supply of water that would but just suffice to mature one acre of paddy would be ample to meet the requirements of two or three acres of wheat.

95. *Maize.*—A plot of land measuring 1,950 square yards was, on the 15th of January, sown with 14½lbs. of maize seed. The soil was a free sandy loam; it was twice ploughed, twice harrowed, manured with 1,500 lbs. of oil cake and fourteen cart-loads of ashes, and ridged. During the growth of the crop the land was five times irrigated and once hand-hoed. The plants grew so luxuriantly, it was found necessary to thin out a considerable number; the weight of fodder thus obtained was 1,134 pounds. The remainder of the plants matured three months after sowing, and produced 1,738 cobs and 1,324 pounds of dry straw. The cobs were small from the plants having been too crowded on the ground. The experiment is worthy of notice, because the sowing was made out of the usual season, September being the usual seed time for maize; and, also, on account of the crop having been occasionally watered instead of treated as a dry crop. If we can succeed in producing as good crops of maize, with the aid of occasional irrigation, from sowings made just after the monsoon as we can produce from sowings made in the usual season, the

change will be well worth adopting, as maize from its tall, upright growth is especially liable to injury from the effects of high winds which generally prevail during the monsoon.

96. *Yellow Cholum* (*Sorghum vulgare*).—I have frequently drawn attention to this valuable fodder-crop, and I would again do so, as its value is yet but little appreciated by those who might benefit most largely by cultivating it. Most of the live-stock on the Sydapet Farms are fed on cholum fodder throughout a greater part of the year; the crop is therefore cultivated on these Farms on rather an extensive scale. The following details refer to a crop which was produced on a plot of ground, measuring 2,494 square yards. The soil was a stiffish loam; before being sown it was prepared in the following way: once ploughed, once harrowed and ridged; then manured with ten cart-loads of farm-yard manure, and again ridged over the manure; the ridges thus formed being about 24 inches apart. The seed was sown on these ridges on the 2nd of June; it germinated well and produced strong and healthy plants. The crop during its growth was hoed by hand twice, and was sixteen times irrigated. The crop, three months after sowing, was cut down for use as fodder, when its total weight was found to be 4 tons 10 cwts. and 50 lbs., equal to 8 tons 15 cwts. 59 lbs. per acre, a quantity sufficient to support two ordinary milch cows during a year.

97. We have occasionally produced much heavier crops than this: thus, the plants growing on 75 square yards of a plot sown with yellow cholum were found to weigh 664 lbs., which is equal to a yield of 19 tons 2 cwts. and 66 pounds per acre. This large yield was obtained only on a portion of the ground, the remainder of the crop not being so good; but the result shows what it is possible to achieve in the production of cholum fodder. This large return was obtained from plants only nine weeks old.

98. *Jute* (*Corchorus Olitorious*).—Several experiments were made in the past year in the cultivation of jute with seed obtained from Bengal. The soil of most of the experimental plots was a free sandy loam. Manure was applied in each instance generally at the rate of about ten cart-loads per acre. The soil was thoroughly worked and cleaned; in some cases it was ridged. The sowing of the different plots was done in different months, some were sown in June, others in July, in August, and in October. The seed was always sown in lines either on the ridge, or on the flat. The distances between these lines varied in the different plots; in some instances the intervals between the lines were 12 inches, while in others they were as much as 2 feet. The quantity of seed sown in the lines also varied in the different experiments. The seed in every instance germinated well, and there was generally a good covering of healthy plants before the expiration of the first fortnight after sowing, but, when about a month or five weeks old the plants began to flower and to throw out side branches, these latter grew with great vigor, and soon exceeded the main stems in size, as a rule, when the height of the plants was not more than 18 inches, these laterals measured from 2½ to 3 feet in length. The flowers on the lower portions of the plants had generally matured and produced seed by the time those on the higher branches had begun to appear. A few plots were planted with seedlings which had been removed from the more thickly-sown crops; these readily took root and grew with great vigor, but they, like the plants from the seeds sown at once in the field, flowered when only about one-third grown, and threw out a large number of side branches. Each experimental plot was hand-hoed and cultivated during the growth of the crop, and a few of the plots were occasionally irrigated.

99. One object of the cultivation was to produce seed for distribution, and in this respect a certain amount of success was achieved, about 150 pounds of seed having been collected; but I did not think it wise to distribute any of it, seeing that the plants from which it was gathered were so inferior in shape and in size. The general results of the experiments were in every instance unsatisfactory, whether the sowings were made during the hot weather or during the rains, whether the seed was sown thickly or thinly, in lines at narrow or wide intervals, or whether the crop was irrigated or watered only by rainfall.

100. It is possible that the seed obtained from Bengal may have been produced in a climate too widely different from that of Madras, but the plants produced from the Sydapet raised seed were in no respect superior to those produced from the Bengal seed. I am inclined to think that the climate of this part of Madras is too dry for jute, and that a climate better suited for its culture will be met with in the northern districts of the Presidency.

101. I made no use whatever of the plants, as I did not consider that the value of the fibre obtained would cover the cost of its preparation.

102. I hope to be able to continue these experiments with seed produced in the northern districts of this Presidency.

103. *Roselle* (*Hibiscus subdariffa*) ; *Sunn Hemp* (*Crotalaria juncea*).—A plot of land, measuring 1,210 square yards, was sown with roselle seed. The soil was a free sandy loam. It was prepared for the crop in the following way : twice ploughed, once harrowed and ridged ; then manured with 3½ cart-loads of farm-yard manure, and again ridged over the manure ; on the 1st of February six pounds of seed were sown on the ridge. During the growth of the crop, the land was once hand-hoed, once bullock-hoed, and eighteen times irrigated. The seed germinated well, and the plants grew with great vigor ; they were straight and almost without side branches, and averaged between 5 and 6 feet in height when ready for cutting, about three months after sowing. As the crop was grown chiefly in view to the production of seed, the fibre of the plants was not utilized ; a few plants were, however, cut down when in flower, in order to ascertain the quality of their fibre, the result was very satisfactory, for the fibre proved to be long in staple, strong, and silky.

104. Another plot of land of the same area as that sown with roselle seed was, on the 2nd of February, sown with 14 lbs. of sunn hemp seed. The treatment of the land was precisely similar to that of the land sown with roselle. It was also similarly manured ; and the treatment of the crop during growth was also the same. The seed germinated well, and the plants grew with great luxuriance, but when they had reached the period for cutting, there was no fibre whatever in their stems. It is, I think, probable that by the liberal use of manure and water, the plants were caused to grow too rapidly for the proper development of their fibre.

105. From the results of these two experiments, it would appear that while high culture is very advantageous to the roselle plant, it has quite a contrary effect on sunn hemp as regards the production of fibre, at any rate on soils similar to those on which these experimental crops were grown.

106. *Guinea Grass.*—A plot of land, measuring 4·77 acres, was, on the 28th November last, planted with Guinea grass ; the soil was a sandy loam of rather a stiffer character than the prevailing soils of this farm. After three ploughings, the land was manured with 4,000 lbs. of cotton seed, the vitality of which had been previously destroyed ; the soil was then raised in parallel ridges about 9 inches in height and 2 feet apart ; the plants were put in on these ridges at every 2 feet, care being taken that the lines they formed across the field were at right angles to the lines formed by the ridges, thus affording facilities for the employment of the plough during the growth of the crop, both between the ridges and across them. The plants, with which the ground was planted, were removed from tussacks of this grass growing in another field. A wet day was selected for planting, and nearly every plant took root. The following shows the cost of planting this field :—

	Rs.	A.	P.
Ploughing three times and ridging	7	8	0
Four thousand pounds cotton seed	40	0	0
Carting and spreading manure...	2	4	0
Labor in planting	8	5	0
Carting plants to field	1	4	0
Total ...	59	5	0
Cost per acre ...	12	6	11

The field has since received one hoeing. No irrigation water whatever has been applied to the crop, either at the time of planting or subsequently. The rain-fall, as will be seen by the following, was during the past three months unusually light:—

Month.	Wet Days.	Inches.
November (from 28th)	1	3·38
December	5	5·11
January	1	0·10
February	—	—
March	1	0·77

The first cutting was obtained in February, and the yield was 3 tons and 56 lbs.; another cutting was obtained in March, which weighed 2 tons and 20 lbs., and there was at the end of the month another crop of about the same weight ready for cutting. The experiment will be continued over another year, and the further results will be reported.

107. I have before recommended Guinea grass as being well suited for culture in the plains of this Presidency, and I would again strongly advise its extended cultivation. It will, I think, form an excellent rotation grass for arable land; at present there is in the agriculture of this Presidency no crop equivalent to the fodder and root-crops of other countries, and this want Guinea grass promises to supply. Not only is the plant from its habit of growth, an entire change for the soil, but the system of cultivation pursued with it, admits of the soil being kept in a fine state of tilth; while the blades of the grass form such a dense covering, weeds are most effectually kept in check, especially those that usually appear in the crops more commonly cultivated. Land which was kept clean with difficulty and at a great expense when under ordinary crops cost very little for weeding when under Guinea grass, this being due to its vigorous growth and to the low and close shade afforded by it, and to the facilities the system of culture affords for keeping down the weeds.

108. Guinea grass is well suited as a change-crop for land that has long been cultivated with one kind of crop only, and has become infested by certain kinds of weeds or insects such as that crop encourages.

109. Guinea grass can be cut over regularly for fodder, or it can be grazed by cattle and sheep; for use in the latter way it is excellent, though in showery weather it is better to utilize it in the former way.

110. Under the system described, the land on which the crop is growing can be manured at any time, and, of course, the more liberally manure is used the better will be the results.

111. *Casuarina Tope.*—A piece of land, measuring 760 square yards, was, on the 5th of July last, planted with 173 casuarina seedlings, aged about 5 months. The dimensions of the pits were 18 inches in each direction; they were made at about 6½ feet apart. A dressing of four cart-loads of farm-yard manure was distributed in the pits at the time of planting. The seedlings took root and grew rapidly; they were five times watered between the time of planting and the close of the year under review. The following shows the cost incurred on this experiment up to the end of the year:—

	Rs.	A.	P.
Digging pits and planting	3	12	0
Value of trees	1	8	0
Do. of manure	4	0	0
Watering	2	8	0
Pruning, &c.	1	0	0
Total ...	12	12	0

These trees have made a most extraordinary growth, their average height on the 1st of April being fully six feet. The further results of the experiment will be duly reported.

Manure.

112. *Loss to Agriculture from the Practice of using Cattle-dung as Fuel.*—It has been asserted with some degree of prominence by a would-be agricultural authority that it is a delusion to believe that Indian Agriculture suffers largely from the general use of cattle-dung as fuel, for the ashes made during the combustion of the dung are, as manure, quite as efficacious as the dung from which they were made. This is but an attempt to revive the old "mineral theory" which, about twenty-five years ago, was brought into considerable prominence by one or two Continental Chemists, who, though eminent in a knowledge of the results of researches conducted in the laboratory, were thoroughly ignorant regarding the processes of agriculture, and the bearing these had on the various physical agencies which aid the husbandman in his work. Agricultural chemistry was at that time but in its infancy, and it was not at all surprising, seeing what grand discoveries chemistry had already made in connection with agriculture, that Chemists should have rather over-estimated the aid they could afford to the Farmer. Amongst those who fell into this mistake was that eminent chemist Baron Leibeg, but he, in his later writings, fully repudiated the mineral theory as originally advocated by him, and brought his views into harmony with those of our English Chemists who had not confined their researches and observations to the narrow limits of the laboratory; there is, perhaps in the present day, not a single Chemist of any repute who would venture to assert that the fertility of land under regular cropping can be sustained by the use of mineral manures alone, that is, using the word "mineral" in the sense in which it was used in the original "mineral theory." The fact is that, even if we do return to our soils the *exact* kind and quantity of mineral foods found in the ashes of the different crops we produce, we will not succeed by these means alone in maintaining the fertility of our land. It would be as sensible to attempt to support a horse in good working condition on a daily pill containing the equivalent of the ash-constituents of a fair daily allowance of ordinary food, as to attempt to maintain the fertility of a soil by returning to it the *exact* quantity *only* of the ash constituents of the preceding crop. The fact is, bulk and dilution are, within certain limits, as essential for the utilization of a manure as of a food, and this is effected in the most perfect way possible by the organic combinations in which these minerals are generally met with in plants; hence, one reason of the superiority of farm-yard manure over ashes, though both may contain the same minerals and in the same proportion. But I have said enough on the "mineral theory;" the question is too large for discussion at greater length here, and the practice of the farmer in every civilized country has afforded ample evidence that the views now held by Agricultural Chemists regarding the original "mineral theory" are sound and accurate.

113. I believe that from the general use of cattle-dung as fuel in this country, our agriculture suffers most severely;—first, from the urine being always wasted when the solid excrements of cattle are collected for burning; second, from the entire destruction of those latent physical powers in the dung which, when it is used in the shape of farm-yard manure, come into operation and produce such beneficial effects on the physical state of a soil; third, from the loss of plant-food dissipated into the air during the combustion of the dung; and last, from so large a proportion of the ashes made being entirely wasted, and the fertilizing properties of the small proportion used as manure being in most instances seriously lessened by the careless way in which they are usually protected from rain during collection.

114. Of course, the fertilizing value of the urine of the ox will depend very greatly upon the nature of the food it consumes; but the following shows its approximate composition and, for comparison, that of the solid excrements also:—

——	Urine.	Dung.
Water	920	840
(*a*) Organic matter, urea, uric acid, &c.	60	135
(*b*) Inorganic matter, salts of potash, soda, &c.	20	25
Total ...	1,000	1,000
(*a*) Containing nitrogen capable of yielding ammonia	9·00	3·60
(*b*) Containing phosphoric acid	·70	2·25

115. It will be seen from this that the urine is very valuable; indeed, by many authorities it is considered the most valuable portion of the excrements of the ox; the loss to this country, then, from allowing this valuable fertilizing agent to run to waste to such a serious extent must be enormous.

116. It is a mistake to suppose that the fertilizing effects of farm-yard manure can be measured and determined by its composition as shown by analysis. Field experiments have proved over and over again, that one ton of farm-yard manure when applied to the soil will produce vastly greater effects than a dressing of a mineral manure containing the ash equivalents of the ton of manure; while the effect of the ashes on the physical state of the soil would be almost imperceptible, that produced by the farm-yard manure would be great and highly beneficial. In no country would the benefits that are conferred on a soil by an application of farm-yard manure be greater than in India, where famines so frequently result from a drought. The power of a soil to absorb moisture from the air, and to retain that moisture in a healthy condition, depends almost entirely upon the quantity and state of the organic matter that soil contains; but, with reference to this matter, I cannot do better than direct attention to the statements made by Dr. Voelcker, in a report printed in the last issue of the Journal of the Royal Agricultural Society of England on the analysis of seventy samples of drainage water collected by pipes, on the Rothamstead Experimental Farm, from plots which had each, for many years, been manured by one kind of manure only. Speaking of the plot that had continuously been manured with farm-yard manure, he says:—

"Notwithstanding the heavy and continuous rains which fell in December, and which caused the pipe-drains from all the other plots to run freely, little or no water passed through the drain-pipe from the plot usually manured with farm-yard manure, and, consequently, no analysis of the drainage from that plot could be made in December 1869. Dr. Gilbert informs me that whilst the pipe-drains from every one of the other plots (dressed with mineral manures) in the experimental wheat-field run freely, perhaps four or five times or more annually, the drain from the dunged plot seldom runs at all more than once a-year, and in some seasons not at all. The fact is the vast accumulation of decomposing organic matter on the plot, annually dunged at the rate of fourteen tons of farm-yard manure per acre, lightens the soil and promotes the disintegration of the clayey portions, and altogether renders the surface-soil more porous and capable of retaining much more water. Hence a much greater amount and continuity of rain is required before the porous surface is fully charged with rain, and an excess can reach the drains."

"This result is interesting and important, for it illustrates in a striking manner the beneficial effects of farm-yard manure on the soil in ameliorating its texture, and generally speaking, its mechanical or physical condition, in consequence of which the growing crops will suffer less during seasons of drought. Messrs. Lawes and Gilbert have found that the dunged soil, when saturated, retained within twelve inches of the surface an excess of water which would be equivalent to about 1½ inches of rain more than that held to the same depth on the unmanured and the artificially 'mineral' manured plots in the same field, which fully explains the circumstance that during the five collections of drainage waters, samples from the dunged plot could be obtained only on two occasions."

117. The direct waste of plant-food by burning dung is great, as the whole of the organic matter which constitutes at least 85 per cent. of dry dung, and which contains amongst other valuable plant-food a large percentage of nitrogen, the most costly and most difficult to replace of all these foods, is dissipated into the air and lost.

118. One of the greatest difficulties with which our Municipalities and Village Authorities have to contend is, the great accumulation of ashes (cow-dung and wood) in our towns and villages; in some instances there having been no other alternative, but to use these ashes in filling holes and other inequalities in the ground.

119. I can always buy for the Sydapet Farms any quantity of ashes—½ cow-dung and ½ wood-ashes—at one anna per cart-load in the village. During the past year, I purchased about 5,600 parahs equal to 480 cubic yards, at 30 parahs or about 6 Annas per cubic yard delivered on any part of the Farm where they were required.

120. I can also purchase *pure* cow-dung ashes at 25 parahs per rupee delivered; now deducting the cart-hire for three cart-loads Annas 9, we have the value of the ashes in the village, *viz.*, 25 parahs for Annas 7, equal to about 3½ Annas per cubic yard, as it takes about 150 pounds of perfectly dry dung to yield one parah of ashes, we arrive at the fact that in the manufacture of one cubic yard of the ashes 1,725 lbs. of dry dung or about 3,000 lbs. of fresh dung must have been used; however, fresh dung is never employed as manure by itself, it is, in all civilized countries, collected with the litter used in bedding, which, also, contains the urine of the animal, and the mass collected forms what is called farm-yard manure. Now, if instead of the 3,000 lbs. of fresh dung having been collected separately for use as fuel, it had been made into farm-yard manure, the quantity would have amounted to certainly not less than 7,000 lbs., or about twelve country cart-loads. I am quite sure that every one who is in the least qualified to form an opinion on the matter will agree with me that the twelve cart-loads of farm-yard manure would produce, when applied to the soil, at the least four times the effect in increased crop returns, that would be obtained from the use in a similar way of the cubic yard of cow-dung ashes. Not only would the immediate effect be greater, but it would continue to act over a much longer period. Again, while the ashes might be washed out of the soil and carried away by the first downpour of rain after their application, the farm-yard manure in the soil could not be removed in this way.

121. If it was necessary to provide food to sustain the people of this country during the famine, if it is necessary to improve the sanitation of the country in order to prevent the outbreak and spread of epidemic diseases amongst the people, and by these means remove the checks which previously existed on the increase of population, surely it is equally necessary to take means to ensure that this increased population can obtain sufficient food. It is of little use endeavoring to remove those causes which tended to keep down the population, if the people thus preserved are to be rendered miserable throughout life from their having to subsist on a semi-starvation diet. The universal practice of burning cow-dung lessens materially the food-producing powers of the country, and the practice, in most instances, is most unjustifiable. Every Ryot can, at a trifling expense, and at little trouble to himself, produce on his land the fuel required for the use of his household. If every Renter of Government land was compelled to grow a certain quantity of fuel trees for each acre occupied, the benefit to the country would be immense in the course of a few years, as cattle-dung would then be set free for use in a legitimate way, and not only would the produce of the land now under cultivation be increased, but much of the land abandoned might again be brought under profitable cultivation.

122. Whether it is good economy on the part of the town-people of this country to use dry cow-dung in the form of bratties for fuel is altogether another question, but I venture to think that it is not good economy, seeing that the selling price of a ton of dry dung is, in most instances, in excess of the selling price of firewood, and, at the least, double the price at which firewood could be produced in the neighbourhood of towns.

123. The following experiment was made to ascertain the quantity of ashes that would be obtained from the dung of two bullocks, and the quantity of fold-yard manure that would be made by other two bullocks, treated alike, during two months. All the bullocks were about the same in age and size, they were all worked during the day, and confined in sheds at night; they were fed on dry straw and cake; the experiment extended over two months, during which there was a great drought and an enormous evaporation; the inside temperature during the time varied between 95 and 105 degrees, and the entire rainfall during the period only amounted to 00·93 inches. Each bullock was confined in a loose-box under cover; in two of

the boxes no litter was supplied, and the solid excrements were removed daily and made into brattıes or cakes ; these, after being thoroughly dried, weighed 189 pounds, and, after burning, yielded 56½ pounds ashes. The cattle in the other two boxes were bedded with 364 pounds of litter ; this litter absorbed the urine of the animals, and with it were mixed the whole of the solid excrements ; the manure, thus made, was found to weigh, at the termination of the experiment, 586 pounds ; the weight would have been very much greater had there been green food available for the animals, or, had the experiment been made during ordinary weather, instead of during a drought ; as, owing to the extreme dryness of the air, the litter, in the manure, contained very little more moisture than when it was first put into the loose-box, its increase in weight being due chiefly to the dry matter of the urine it had absorbed, and which, weight for weight, is much more valuable than the dry matter of the solid excrements. This is the first of a series of experiments of the kind intended to be made at different seasons of the year and under different conditions.

124. *The Fern.*—The species to which the following remarks refer is the *Pteris Aquilina* generally known as the *bracken*, which is found abundantly in many parts of the higher hill ranges of this Presidency. The bracken is used as a litter for cattle stalls, &c., very largely by Coffee Planters resident on the Neilgherris, in Wynaad and in Coorg ; for this purpose it is well suited where the straw of cereals is costly and difficult to obtain. It is much slower in decomposing than ordinary straw, and its stem being solid instead of hollow, it is in the fresh state unable to take up much moisture, but the mass formed by decomposed ferns is quite as able as decomposed straw to take up and retain moisture. When used in cattle-boxes, the fern rots more readily than in ordinary byres ; it is used chiefly in the large open " crawls " in which buffaloes and hill cattle are confined at night. It is the practice with many Planters to erect these cattle-crawls at convenient distances from their estates, and to induce the hill people, by the payment of a small sum, to confine their cattle within them at night. These " crawls " are kept liberally bedded with ferns, grass, &c., which, under the treading of the cattle at night, aided by frequent rain, become broken up and worked into a black-colored mass ; this is a convenient and expeditious way of working up ferns, &c., into a form convenient for use as manure ; but I greatly doubt the wisdom of the practice, as, not only must there be a great loss of soluble fertilizing matters by the frequent washing by rain to which the manure is exposed, especially during the later stages of decay, but owing to the enormous absorption of rain-water by the manure, the cost of conveying it to the coffee trees will be, at the least, twice as great as it should be.

125. The following is an average analysis of the composition of the ash of the bracken made by Professor Emil Wolff of the Royal Academy of Agriculture at Hohenheim, Wirtemberg ; and also, for comparison, an average analysis of wheat-straw by the same eminent chemist :—

	Bracken.	Wheat Straw.
Per cent of Ash	7·01.	4·95.
Composition of the ash—		
Potash	42·8	11·5
Soda	4·5	2·9
Magnesia	7·7	2.6
Lime	14·0	6·2
Phosphoric acid	9·7	5·4
Sulphuric acid	5·1	2·9
Silica	6·0	68·3
Chlorine	10·2	——
Total ...	100·	99·8

It will be observed in comparing these analyses that not only does the fern yield a much larger quantity of ash than wheat-straw, but that more than one-half of this ash consists of the highly valuable fertilizing minerals, phosphoric acid and potash, both so essential in a soil on which coffee trees are growing. It will be further observed that the ash of the fern is twice as rich in lime as the ash of the wheat-straw. Of course, there is always a considerable difference in the composition of the ash of the same plant produced on different soils, or under different conditions as regards cultivation and manure. However, as the fern is generally found growing on uncultivated land, the composition of its ash is somewhat more uniform than that of the ash of cultivated plants, and I think, for all practical purposes, the analysis I have given may be accepted—until we are in possession of an actual analysis of our hill-produced ferns—as fairly approximating to the analysis of the ferns used by planters in the way I have described. The percentage of lime may be on the average somewhat less, but I do not think that there would be any appreciable difference in the percentage of the other constituents of the ash.

126. *Lime.*—As far as I have been able to ascertain, lime is not used as a manure in any part of Southern India; our Cultivators appear to be entirely ignorant of its fertilizing qualities. Seeing how universally the value of lime, as a manure, is acknowledged by Agriculturists in almost every other part of the world, it is but little to the credit of Indian Cultivators that they should have remained so long in ignorance regarding a manure which enters so largely into the food of all cultivated plants. It is true that in many localities in this Presidency, the price that must be paid for lime is twice as great as the average cost of lime to the British Farmer; but the neglect with which lime has been treated by our Cultivators is certainly not due to its costliness, for in districts where it can be obtained more readily and at less expense, its use as a manure is equally neglected. The various experiments made on the Sydapet Farms in the use of lime as a manure have proved conclusively its value, especially for such crops as indigo, cotton, maize, tobacco, &c. But the light soils of the Sydapet Farms are not so well adapted for exhibiting the benefits derived from a dressing of lime as soils which contain a larger proportion of clay and vegetable matter. There are soils on these Farms peculiarly suited to benefit from an application of lime, but full advantage could not be derived from such a dressing until, by sub-soil draining, they have been rendered less swampy than they now are at certain seasons. I have used dressings of, from 10 cwts. to 20 cwts. per acre, spread broadcast over the soil, and I find that not only does the lime supply the peculiar food needed by our principal field crops, but it tends to render our light soils more compact, and makes them more capable to withstand the ill-effects of a long drought. The high price of lime at Sydapet prohibits its use in such dressings as in England are usually applied at one time; but even if lime was procurable on more reasonable terms for the Sydapet Farms, it would not, I think, be advisable to apply it in heavy dressings to the light soils, of which they chiefly consist; with such soils, it is I think best to apply light dressings of, say, 20 cwts. per acre at intervals of three or four years, instead of, as is usual in England, applying from 6 to 9 tons in one application at intervals of about fifteen years.

127. Lime forms the chief constituent of the ash of most plants cultivated in the field. All fertile soils contain a greater or less quantity of lime. Not only does lime afford the food needed by our crops, but by its action in the soil it sets free mineral food which was previously inert and of no use to growing crops. Lime, when applied to a soil, has other valuable properties in addition to those already noticed; it removes the acidity of a sour soil; it hastens the decomposition of animal and vegetable substances; as a dressing for heavy clay or recently exposed soil, it is invaluable in its mellowing influences; and, when applied to soils on which fruit trees are growing, it has a wonderful effect for good on the quality and flavor of their produce. A piece of ground of stiff tenacious clay, on the Experimental Farm on which the plantain trees yielded a coarse fruit, almost uneatable, was dressed with lime, after which there was a remarkable change in the quality of the fruit, not only was the flavor all that could be desired, but the skin, which before was coarse and woody, became very thin and fine, and separated easily from the edible portion.

128. It is perhaps as well, all things considered, that our Ryots should have been so ignorant regarding the action of lime on the soil; while lime in the hands of an intelligent Farmer is one of the most valuable manures that can be used, it is very unsafe in the hands of ignorant improvident Cultivators, as by its aid they are able to exhaust a soil very rapidly of its fertilizing ingredients. Soils which may for a long period continue to yield crops such as our Ryots now produce would, if deeply ploughed and dressed with lime, without the aid of other manure, yield very much larger returns, for a time, but the after effects would be that the soil would become less and less productive: the increased return produced by the lime, in addition to its own direct supply of food, being due to its action on the mineral constituents of the soil which were before either entirely inert, or only sufficiently active to supply the wants of the small crops previously produced. Of course, the object of the Farmer is to keep the mineral food in his soil in as active a state as possible. In good farming, the practice is to turn over this food, frequently and rapidly, by producing large crops in quick succession, but to enable this to be done, manure of the right quality and in proper quantities must be used freely in addition to lime, it is rather as a manure for use under high farming that lime is to be recommended to the Farmer; and while it is to be regretted that the conditions met with in the practice of agriculture in this country are not yet such as to render it advisable that our Ryots should be encouraged to use lime freely, the time is, I hope, not far distant when it may be safely recommended to their notice.

Sub-soil draining.

129. My remarks in a former report on sub-soil draining have, in some instances, been misunderstood, evidently from a want of knowledge of what sub-soil draining really means. When making those observations I thought it unnecessary to describe in detail the way in which pipe-drains act, seeing that so much has been written on the subject. It has been contended by some that, if water is so essential for the proper growth and development of field crops in Southern India, that it will be exceedingly unwise to attempt to lessen the quantity of this element in our soils. It must be remembered that no description of sub-soil drains can remove from a soil the whole of the moisture it contains, there is always even in the most perfectly drained land a considerable quantity of water which no drainage can remove. It has been found again and again that a well-drained soil contains during a drought more moisture than an undrained soil of similar character and composition; there are many reasons why this is so; drainage facilitates the working of a soil by field implements, not only in the greater perfection of the work done, but in affording a longer season in which to do the work under favorable conditions, and as a thoroughly-tilled soil is always well pulverised and therefore more porous, its capabilities to retain water by suspension are greatly increased, as well as its abilities to absorb moisture from the air. A proper seed-bed cannot be obtained in a soil in which there is too much water; for the germination of seed and the healthy growth of plants, atmospheric air must be present in the soil, and this cannot be there in a sufficient quantity when the soil is full of water. Further, a water-logged soil is always cold, not only on account of the great reduction of temperature caused by the evaporation of its water, but also because heat cannot penetrate into it. Tropical plants suffer very much when the temperature of the soil on which they are growing becomes too greatly reduced. During the prevalence of the north-east monsoon in this district, when we have had a succession of wet days with a clouded sky, I have frequently observed crops turn sickly and yellow, which previously were very healthy in appearance; and such crops seldom did well after their growth was checked in this way, as they were generally afterwards attacked by the fungoid disease "rust." I have not yet had an opportunity to make any experiments regarding the temperature of the soil at such times, but I believe that the check in growth is due almost entirely to the low temperature of the soil, as the crops growing on the drained land remained green and healthy.

130. There are, of course, soils that do not require to be artificially drained, being sufficiently well drained naturally; I only advocate the removal by sub-soil drainage, of water the land will not hold in suspension, or the water of springs immediately under cultivated land.

131. Soils differ greatly in their capacity to hold water in mechanical suspension; thus it has been found that —

100 lbs.	of quartz-sand	will absorb	25 lbs. of water.
,,	of calcareous sand	do.	29 lbs. of do.
,,	of loamy soil	do.	40 lbs. of do.
,,	of English chalk	do.	45 lbs. of do.
,,	of clay loam	do.	50 lbs. of do.
,,	of pure clay	do.	70 lbs. of do.

132. The pipes used in sub-soil draining should be placed for carrying off surplus water at a depth sufficiently great to allow of the upper soil forming a rough filter bed, to which the rain water in passing through would give up the fertilizing matter and air it holds. Messrs. Laws and Gilbert, the eminent chemists, have found in England that in a rain-fall of thirty inches in one year, the rain-water that fell on an acre of land carried down with it as much as 7 lbs. of ammonia, which is equal to the quantity contained in a dressing of manure frequently thought sufficient for the wants of one crop.

133. In a hot country such as this, sub-soil ploughing and other deep cultivation are absolutely necessary in order to secure the full benefits that result from sub-soil draining. A soil that is simply drained, the particles of which are not separated and loosened under the influences of deep cultivation, cannot in a dry season be expected to take up more moisture from the atmosphere, than undrained land of the same kind in a similar mechanical state. The absorption of moisture from the air can only occur in porous soils into which the air can pass freely; sun-dried, hard, compact soils are quite incapable of absorbing moisture from the air. As in this country, at night, the air near the surface of the ground is at certain seasons so heavily charged with moisture, it is especially necessary, in order to secure this moisture, that our soils should be kept as open and as porous as possible.

Implements and Machines.

134. The following new implements and machines were imported from the United States during the past year;—

135. *Cast-Iron Plough.*—This is a small plough to be drawn by a single horse or mule, and is intended for use in cotton culture. The working parts of the plough are made of cast-iron, and its stilts and beam of wood. The cash price in New York was 3 dollars 38 cents, and its cost delivered at the Sydapet Experimental Farm was only 10 Rupees. The plough is unfortunately faulty in construction; its mould-board is set nearly at right angles to the beam, thus causing the draught to be very heavy; and the slade is so short, the plough moves very unevenly through the soil, in places going so deeply that it becomes embedded and fixed; by placing a wheel under the beam the latter drawback would no longer be experienced, and a slight alteration in the position of the mould-board would greatly reduce the draught. The cast-iron working-parts, also, are objectionable; they are so liable to be broken when in use by coming into contact with stones or the roots of trees. Implements that are fitted with working-parts made of cast-iron are not yet suited for general use in this country; much annoyance and loss have already been experienced from the purchase of such implements.

136. A plough of the kind under notice could readily be made with wrought-iron working parts and with a wheel, but the cost would be 50 per cent. greater than the price of the unimproved plough.

137. The following shows the results of an experiment made with this plough :—

Weight of Plough.	Draught registered.	Work done.		
		Depth of Furrow.	Width of Furrow.	Earth removed in 100 yards length of Furrow.
Pounds.	Pounds.	Inches.	Inches.	Cubic yards.
34	448	9·00	13·53	9 39

The soil had been recently stirred and was free and open. Nine and-a-third cubic yards for every one hundred yards of furrow is about double the amount of work usually performed by our ploughs, and is, I think, beyond the strength of the plough when in regular work, while the draught required to do so much work is too great for an ordinary pair of cattle.

138. *Steel Plough.*—This plough is similar in general apparance to that, to which I have just referred, but differs from it in having a steel mould-board with polished cast-iron share and land side, while its mould-board is less abrupt. The cash price of this plough in New York was 6 dollars and 30 cents, and its cost delivered at the Sydapet Experimental Farm was Rupees 18. The following is the result of an experiment made with this plough :—

Weight of Plough.	Draught registered.	Work done.		
		Depth of Furrow.	Width of Furrow.	Earth removed in 100 Yards' Length of Furrow.
Pounds.	Pounds.	Inches.	Inches.	Cubic Yards.
45	280	7·	11·	5·94

This experiment was made at the same time as that previously noticed and under similar conditions ; it will be observed that for the draught absorbed the result was better than that obtained with the cast-iron plough. The plough under notice possesses, though in a lesser degree, most of the faults to which I alluded when referring to the cast-iron plough. Steel mould-boards are considered to be much more durable than those that are made of cast iron, while, as the soil adheres less readily to polished steel, the draught of ploughs fitted with these mould-boards is lighter than that of ploughs fitted with ordinary mould-boards.

139. *Maize Sheller.*—Specimens of three kinds of maize shellers were obtained : single-wheel sheller, double-wheel sheller, and eagle sheller. The first and second differ only in the number of wheels each has ; they are intended for ordinary light work with manual power. The eagle sheller is a stronger and larger description well suited for continuous and heavy work. The single-wheel sheller cost in New York 9 dollars and 90 cents, and delivered at the Experimental Farm Rupees 27 ; the double wheel sheller cost delivered each Rupees 3 more. The cost of the eagle sheller delivered at the Sydapet Experimental Farm was Rupees 40 ; its price in New York was 14 dollars and 40 cents. These are all very useful machines ; each of them is capable of doing a large amount of work, and at a cost far below that usually incurred in this country for shelling maize.

140. *Winnowing Machine.*—This is a very handy little machine, and is well suited for the use of Ryots having more than 30 acres of arable land. Its cost delivered at the Experimental Farm was only Rupees 45.

141. *Chaff Cutters.*—Two specimens of the variety known as the national feed-cutter were obtained. Their knives are fixed obliquely on a cylinder ; they cut with great rapidity the thick stalks of maize, cholum, &c., as well as the finer grasses. The cost of these machines delivered at the Experimental Farm was Rupees 45 each. They are greatly superior in every way to machines fitted with ordinary vertical cutting knives, and their cost is not greater.

MODEL FARM.

142. In my last annual report I stated in detail the circumstances under which this farm was begun ; it is therefore unnecessary here to do more than mention that the land, when appropriated for the purposes of this farm, was in a most wretched condition, having been completely ruined, and then abandoned, by the Native Cultivators in whose hands it had been. The close proximity of land in this wretched state to the Experimental Farm was considered very objectionable, and the Committee, who at that time had control over the farm, thought, and I thought the same, that, if the land was taken up and worked as a Model Farm, it might be improved in appearance and in value, and a fair return be obtained on the outlay. The results of the experiment so far amply justify the opinions then formed, as far as relates to an improvement in the appearance and value of the land, but I am now convinced that it was *a mistake to begin*

an experiment to test the financial results of improved farming on land so much out of order as that taken up. It is a very different affair to open up a farm on fresh land, or land that has been fairly cultivated, than it is to establish a farm, and to work it on a good system, on a piece of worn-out land with a surface excavated and broken up in all directions.

143. The condition of the soil as regards productiveness proved to be very much lower than had been anticipated. There were a few small plots scattered over the farm on which trees had been growing that produced moderately good crops; but over fully two-thirds of the area the soils did not on the average produce 5 bushels of grain per acre and some of the land did not yield even half this quantity, while the broken surface rendered it impossible to work improved implements with any chance of success.

144. During the first two or three years after the farm was started, the surface of the land was restored to something like its natural state, but my time was then so fully occupied, and, having no one available to superintend the work, I was unwilling to expend more money in levelling the land than was absolutely necessary to admit of the proper working of improved implements and machines, but this limited improvement was altogether insufficient to secure a return that we had a right to expect from the greater care devoted to the cultivation of the land. When we succeeded in bringing a crop to maturity under satisfactory conditions, the result was very encouraging, but from their unfrequency these better crops contributed but little to the general income of the farm. The crops generally continued to be almost as precarious as when the land was first taken up. From the effects of floods and droughts not more than one sowing in every four or, five reached maturity. The interest and other charges on the cost of these *partial* improvements formed a heavy and accumulating burden against the farm without, as just noticed, producing any results of a corresponding value.

145. I was not long in forming the opinion that, before we could hope to secure satisfactory financial results from farming the land on a moderately good system of husbandry, it was necessary to complete fully, and with as little delay as possible, the improvements contemplated, for, though the immediate expense would be great, it would perhaps not be greater than if the improvements were effected gradually. Accordingly in the beginning of the last official year, the services of an Assistant being then avaliable, and the showery weather enabling earthwork to be done at a very moderate cost, I engaged a large gang of laborers and pushed forward with vigor the work needed to be done in levelling the land; this was continued throughout the summer months and until the commencement of the north-east monsoon. The work, of course, interfered greatly with the cropping of the farm and seriously lessened the income of the year, but the diminished income of the farm is far more than counterbalanced by the increased value of the estate for, the weather continuing showery throughout the whole period, the improvements were effected at a very moderate cost.

146. The surface of the land is now almost all that could be desired; heavy rains, which previously cut up and rutted the sandy soils and carried off the manure which had been applied, now do but very little damage, a greater portion of the water passing into the soil and that unabsorbed running away into surface drains. This general improvement in the lay of the land, with the provision of surface drains, has done much to prevent the accumulation of stagnant water especially in the irrigated land, but the portion of this and of the dry land liable to be submerged during floods of the river Adyar needs further attention, probably subsoil drainage will be necessary in order that the land when saturated after the floods may be speedily relieved of stagnant water. Unfortunately the portion of the farm thus circumstanced is the best part, and, as the floods generally occur in October or the beginning of November, little can be done in cropping the land until the beginning of December, when the floods are over, and in three years out of every four cereal crops sown so late never reach full maturity unless occasionally irrigated, and water is available only for a few acres of this land and frequently only up to the end of February, when the late-sown crop is but two-thirds grown.

147. But, before good results can be regularly secured from the working of this farm on a moderately good method, it is necessary, not only to lessen the ill-effects of the floods of the Adyar, but it *is absolutely needful that a plentiful and certain supply of irrigation water should be secured over the greater portion of its surface.* Under present circumstances the area that can be watered is very small, and the supply of water seldom lasts more than four months, generally ceasing just when it is most urgently needed to bring the crops to maturity.

148. A small tank, the water of which enabled the crops to be sown on a considerable area of the wet land somewhat earlier than would have been possible if the ordinary irrigation source was relied on, and which proved of great use in maturing crops after the irrigation source had failed, was last year taken from the farm and given over to the charge of another department, and, the loss caused thereby last year was great, as a large area of paddy on the ground that was flooded in the early part of the season by the river altogether failed from there being no water to bring it to maturity; had the farm had the use of the tank as in former years, this loss would not have occurred.

149. Good farming demands that means must be at command to lessen the ill effects of droughts and floods, and that the work of the farm must progress with some degree of uniformity throughout the year. In the case of this farm, as already pointed out, the crops suffer both from droughts and from floods; and, from the absence of a continuous supply of irrigation water, the real work of the farm is limited to a period of not more than five months in the year. This, in the case of a Ryot would have mattered but little, as, during the inactive period, he would entirely suspend all expenditure and leave his draught cattle to exist on such scanty food as they could collect on the road sides and other waste places. But such a course could not be followed on a Public Farm, which must be kept in good order, under any circumstances, throughout the year. The outlay on this farm during this inactive period last year amounted to not less than Rupees 1,500, which was practically unremunerative expenditure and which should not fairly be debited in an experiment of a *commercial* nature. Hence the necessity of the farm being provided with water to enable its cultivation to be conducted throughout the year, and in this way, while keeping up its condition, produce a remunerative result on the labor thus expended. But the fact is, a Public Farm never can be conducted on *strictly commercial principles*; there is always, even on farms in good cultivation, a large amount of work of a semi-ornamental kind to be done, which produces no direct return, and the amount of this description of work on a farm in the course of formation is necessarily greater.

150. The balance sheet on the 31st March 1875 was as follows:—

LIABILITIES.	RS.	A.	P.
Loan from General Funds for 1870-71	2,776	9	10
Do. do. 1871-72	1,310	3	11
Do. do. 1872-73	1,772	2	2
Do. do. 1873-74	1,522	13	8
Do. do. 1874-75	3,082	9	8
Laborers' pay due for March 1875	187	1	5
Outstanding bill	31	7	6
Total ...	10,683	0	2

ASSETS.					
Cattle.					
15 Working cattle...	900	0	0		
Sheep.					
15 Rams 29 Ewes 6 Wethers 15 Lambs	320	0	0		
Poultry	60	0	0		
				1,280	0	0

				Rs.	A.	P.
	Implements.					
	Implements, tools, carts, &c., as catalogued			861	8	10
	Manures.					
	Manure of sorts	45	0 0			
¼	Cost of manure purchased in 1873-74	10	5 11			
¼	Cost of cake purchased in 1873-74	132	15 9			
½	Cost of manure purchased in 1874-75	231	3 0			
½	Cost of cake purchased in 1874-75	268	14 7			
				688	7	3
	Fruit and Fuel Trees, &c.					
	Cocoanut and mango trees Casuarina trees Guava trees			1,350	0	0
	Fruit crops			450	0	0
	Field Crops.					
	Grain and pulse crops Guinea grass Fodder crops of sorts			400	0	0
	Seeds, &c., in Granary.					
175	Pounds of Carolina paddy	5	13 4			
775	Do. sumba paddy	15	8 0			
7	Do. green gram	0	5 1			
15	Do. horse gram	0	6 4			
27	Do. yellow cholum	0	10 10			
521	Do. cumboo	26	0 10			
87	Do. maize	4	5 7			
10½	Do. indigo seed	1	0 0			
22½	Do. wool	3	8 3			
27	Do. cotton in seed	2	4 0			
				59	14	3
	Sundries			60	0	0
	Cultivations done for next season's crop			75	0	0
*	Uncollected bills			481	3	0
	Difference, being balance against the farm			4,976	14	10
			Total ...	10,683	0	2

151. The following are the details of Income and Expenditure during the past year :—

	Expenditure.	Rs.	A.	P.
	Rent and interest...	913	1	6
	Overseer's salary	647	8	0
	Labor	1,589	12	4
	Cattle	25	0	0
	Pigs	168	14	10
	Sheep	135	2	0
	Poultry, rabbits, &c.	4	12	6
	Implements, machines, and tools	334	1	4
	Seeds	182	10	1
	Cattle food	537	13	2
	Manure	462	6	0
	Sundries	56	3	7
	Total ...	5,057	5	4

* Consists chiefly of debts due by the Estate.

Income.

	Rs.	A.	P.
Advance from General Funds	3,082	9	8
Cattle	85	0	0
Pigs	344	0	11
Sheep	132	3	5
Poultry, rabbits, &c.	84	1	0
Fruits, plantain, and vegetables...	568	2	11
Grains, fodder, &c.	408	3	7
Indigo, cotton, and sundries	352	15	10
Total ...	5,057	5	4

Expenditure from commencement of the Farm up to and including the 31st of March 1875.

Items.	*1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			Total.					
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cooly labor...	1,105	4	2	1,375	9	11	1,369	14	0	1,317	1	11	1,589	12	4	6,757	10	4			
Manure	3	0	0	71	1	4	185	2	7	41	7	7	462	6	0	763	1	6			
Live stock	1,641	15	0	731	6	8	636	3	0	252	10	3	333	13	4	3,596	0	3			
Food for live stock	267	11	9	557	7	3	506	3	11	531	15	1	537	13	2	2,401	3	2			
Seeds, trees, &c.	194	1	7	91	6	7	153	9	2	122	13	5	182	10	1	744	8	10			
Implements, tools, &c.	461	9	0	18	13	0	277	8	6	67	5	0	334	1	4	1,159	4	10			
Contingencies	74	4	9	100	2	3	16	6	9	16	10	2	56	3	7	263	11	6	15,685	8	5
Overseer's salary	113	12	0	370	0	0	600	0	0	610	0	0	647	8	0	2,341	4	0			
Rent	192	8	0	385	0	0	385	0	0	385	0	0	385	0	0	1,732	8	0			
Interest on capital employed in working the farm...	69	8	4	150	0	0	200	0	0	200	0	0	200	0	0	819	8	4			
Interest on capital expended on improvements of a permanent character	94	6	7	296	1	8	328	1	6	328	1	6	328	1	6	1,374	12	9	6,268	1	1
																		Total...	21,953	9	6
																		Unpaid bills...	218	8	11
																		Total...	22,172	2	5

* Half-year.

Income from commencement of the Farm up to and including the 31st of March 1875.

Items.	*1870-71.	1871-72.	1872-73.	1873-74.	1874-75.	Total.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Cattle	403 1 9	560 14 9	371 15 0	419 7 5	85 0 0	1,840 6 11
Sheep	... ...	141 10 6	237 2 6	188 10 9	132 3 5	699 11 2
Pigs	... ...	263 14 0	664 5 9	390 11 6	344 0 11	1,663 0 2
Poultry, rabbits, &c.	12 6 0	97 8 0	203 4 0	65 2 10	84 1 0	462 5 10
Fruits, plantain, and vegetables, &c....	474 12 6	582 10 3	444 1 6	290 1 11	568 2 11	2,359 13 1
Hay, green fodder, &c...	42 8 0	256 6 0	484 13 6	238 11 3	150 1 10	1,172 8 7
Grains	407 0 10	705 9 3	178 11 2	411 5 7	258 1 9	1,960 12 7
Indigo and cotton	... ...	... ...	... ...	232 12 6	7 8 0	240 4 6
Sundries	101 10 3	228 4 0	301 9 10	113 3 6	345 7 10	1,090 3 5
Total...	1,441 7 4	2,836 12 9	2,885 15 3	2,350 3 3	1,974 11 8	11,489 2 3
Add the valuation of the assets on the 31st of March 1875						5,706 1 4
Total...						17,195 3 7

* Half-year.

152. The actual results of the experiment are not fully brought out in the financial statements just given, much of the balance standing against the farm being for expenditure incurred for work which, though not exactly estate work, was fairly debitable against the estate, not being directly remunerative to the farm, though necessary for its successful working and to enable it to pay rent. Besides this the whole time of the Farm Overseer, who carried on the estate improvements, is debited against the farm, and there are other items which might be credited to the farm, such as up-keep of roads used by visitors, the value of the tank, the charge of which was taken from the farm last year, and given over to the charge of the Collector of Chingleput, for the use of his office establishment, &c.

153. All things considered, it would perhaps be the fairest way of now dealing with the experiment to consider the balance against the farm as expenditure on behalf of the landlord to be dealt with as with other expenditure on permanent improvements, to push on energetically to completion the whole of the contemplated improvements, and at the end of the present year, if these improvements are then completed and the farm amply supplied with irrigation water, to have the whole of its soils valued by the Settlement Department, the rent thus fixed to be the ultimate rent of the farm *without any other charge*. It might be that the rent fixed by the Settlement Department would represent but a small percentage on the total capital sunk on permanent improvements, but it must be remembered that expenditure incurred in bringing back into cultivation a worn-out exhausted arable soil is seldom directly remunerative.

IMPLEMENT WORKSHOPS.

154. The income of these workshops during the past year amounted to Rupees 2,243-11-9 and the expenditure on their behalf was Rupees 2,120-12-0.

155. There was a balance against the workshops at the end of the official year 1873-74, amounting to Rupees 540-0-4, which at the close of the year under review had been reduced to Rupees 424-15-8.

156. These workshops supplied during the year thirteen combined ploughs, seven iron ploughs, three maize shellers, one chaff cutter, one drag harrow, and a number of smaller implements and tools besides doing all the repairs needed by the implements, machines, &c., used on the Sydapet Farms. The following shows where these implements, &c., were sent :—

Province or District.	Combined Ploughs.	Iron Ploughs.	Maize Shellers.	Chaff Cutters.	Drag Harrow.
Burmah	1	...	...	...	...
Cochin	...	1	...	...	...
Coimbatore	...	2	...	1	...
Madras	2	1	...	...	1
North-Western Provinces	7	...	...	...	...
Nilgiris	2	1	...	...	...
Port Blair	...	...	3	...	...
Travancore	1	1	...	...	...
Trichinopoly	...	1	...	...	...
Total ...	13	7	3	1	1

157. At the close of the year there remained several registered applications for machines and implements.

The following are the details of income and expenditure during the past year :—

Income.

	RS.	A.	P.
Machines, &c.	792	4	6
Labor, materials, &c.	1,451	7	3
Total ...	2,243	11	9

Expenditure.

	Rs.	A.	P.
Buildings	9	15	0
Plant	23	10	0
Cooly labor, &c.	1,025	4	3
Materials, &c.	931	14	9
Interest on capital	130	0	0
Total ...	2,120	12	0

Implement Workshops' Balance Sheet on the 31st March 1875—

Liabilities.

Loan from General Funds for 1870-71	883	1	5
Do. do. 1871-72	213	1	2
Do. do. 1872-73	1,077	3	2
Outstanding bills	142	2	0
Laborers' pay due for March 1875	94	10	0
	2,410	1	9
Deduct capital returned by excess of income over expenditure during 1873-74 ... ... 213 10 5			
Deduct capital returned by excess of income over expenditure during 1874-75 ... ... 122 15 9			
	336	10	2
Total ...	2,073	7	7

Assets.

Buildings	419	15	3
Plant	321	1	6
Materials	251	12	2
New implements, machines, &c., in stock	352	0	0
*Outstanding bills	303	11	0
Deficiency	424	15	8
Total ...	2,073	7	7

Establishment.

158. I have received much valuable aid from my Assistants Mr. Charles Benson, M.R.A.C., and Mr. Kaspar Schiffmayer. During my absence from duty for three months last year on privilege leave Mr. Benson had charge of my office, and Mr. Schiffmayer had charge of the working of the Sydapet Farms. There is nothing in the conduct of the Overseers, Clerks, or Apprentices that needs special notice here; all have performed their respective duties in a satisfactory way.

SYDAPET,
11th September 1875.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

* Since collected.

APPENDICES.

Rain-fall registered at the Experimental Farm during the year ending 31st March 1875.

April 1874.	May 1874.	June 1874.	July 1874.	August 1874.	September 1874.	October 1874.	November 1874.	December 1874.	January 1875.	February 1875.	March 1875.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1... ...	1... ...	1... ...	1	1 ... 2·55	1	1	1	1	1	1... 0·77
2	2	2... ...	2... ...	2	2 ... 0·34	2	2	2	2	2	2... ...
3	3... ...	3... 1·60	3... ...	3	3 ... 0·47	3	3	3	3	3	3... ...
4	4... ...	4... 0·63	4... ...	4	4	4	4	4	4	4	4... ...
5	5... 5·80	5... ...	5... ...	5	5 ... 0·53	5 ... 1·15	5	5	5	5	5... ...
6	6... 0·71	6... ...	6... 0·84	6 ... 0·45	6 ... 0·54	6	6 ... 0·40	6	6	6	6... ...
7	7... ...	7... ...	7... ...	7	7 ... 0·53	7	7	7	7	7	7... ...
8	8... ...	8... 2·45	8	8	8	8	8	8	8	8	8... ...
9	9... ...	9... 0·25	9... 0·82	9	9	9	9 ... 1·00	9	9	9	9... ...
10	10... ...	10... ...	10... ...	10 ... 0·29	10 ... 2·38	10	10	10	10	10	10... ...
11	11... ...	11... ...	11... 0·62	11 ... 0·25	11	11	11	11 ... 0·77	11	11	11... ...
12	12... ...	12... ...	12... ...	12	12	12	12	12 ... 2·30	12	12	12... ...
13	13... ...	13... ...	13... 0·14	13	13	13	13	13	13	13	13... ...
14	14... ...	14... ...	14... ...	14	14 ... 0·44	14	14	14 ... 1·50	14	14	14... ...
15	15... ...	15... 0·42	15... ...	15	15	15	15	15 ... 0·44	15	15	15... ...
16	16... ...	16... ...	16... ...	16	16	16 ... 2·99	16	16	16	16	16... ...
17	17... ...	17... ...	17... 0·33	17	17	17	17 ... 0·10	17	17	17	17... ...
18	18... ...	18... ...	18... 1·78	18 ... 1·10	18 ... 0·50	18	18 ... 0·25	18	18	18	18... ...
19	19... ...	19... ...	19... 0·15	19	19	19 ... 0·24	19	19	19	19	19... ...
20	20... ...	20... ...	20... ...	20 ... 0·25	20	20	20	20	20	20	20... ...
21	21... ...	21... ...	21... ...	21	21	21 ... 0·88	21	21	21	21	21... ...
22	22... ...	22... ...	22... ...	22	22	22 ... 1·09	22	22	22	22	22... ...
23	23... ...	23... ...	23... ...	23	23 ... 0·43	23 ... 2·86	23	23	23	23	23... ...
24	24... ...	24... ...	24... ...	24	24	24 ... 7·67	24	24	24	24	24... ...
25	25... ...	25... ...	25... ...	25	25	25 ... 3·41	25	25	25 ... 0·10	25	25... ...
26	26... 0·28	26... ...	26... ...	26	26	26 ... 1·39	26 ... 1·06	26	26	26	26... ...
27	27... ...	27... 0·22	27... ...	27	27	27 ... 0·28	27 ... 3·06	27	27	27	27... ...
28	28... ...	28... ...	28 .. 0·78	28	28 ... 0·69	28	28	28 ... 0·10	28	28	28... ...
29	29... ...	29... 1·09	29... ...	29	29 ... 1·19	29	29	29	29	... ...	29... ...
30	30... ...	30... ...	30... ...	30	30	30	30 ... 3·38	30	30	...	30... ...
	31... ...		31... ...	31		31		31	31		31... ...
Total...None.	Total.6·79	Total.6·66	Total.5·46	Total ...2·34	Total...10·59	Total...21·91	Total... 9·25	Total... 5·11	Total...0·10	Total None.	Total 0·77

EXPENDITURE ON ACCOUNT OF THE MADRAS AGRICULTURAL DEPARTMENT.

	Rs.	A.	P.	Rs.	A.	P.
I. *General Supervision.*						
Establishment *	16,872	1	5			
Travelling allowance	1,048	4	5			
Contingencies	270	3	2			
				18,190	9	0
II. *Madras Experimental Farm.*						
Establishment	989	10	11			
Cooly labor	3,000	12	11			
Implements and machines	917	2	9			
Live stock	244	11	4			
Seeds	418	9	0			
Food for live stock	1,696	5	4			
Manure	380	8	1			
Despatching seeds	153	3	0			
Contingencies	355	2	8			
				8,156	2	0
III. *Madras Model Farm.*						
Establishment	647	8	0			
Cooly labor	1,589	12	4			
Manure	462	6	0			
Live stock	333	13	4			
Food for live stock	537	13	2			
Seeds	182	10	1			
Implements, carts, and water-lifts	334	1	4			
Rent and interest	913	1	6			
Contingencies	56	3	7			
				5,057	5	4
IV. *Implement Workshops.*						
Carpenters, smiths and filer	768	13	6			
Cooly labor	261	13	9			
Machines, implements, and materials	960	0	9			
Interest on capital	130	0	0			
				2,120	12	0
V. *Educational.*						
District Farm Apprentices	1,157	5	8			
Sydapet do. do.	1,353	5	10			
Schoolmaster for laborers' children	81	8	9			
Books, &c., for library	48	13	0			
Analytical laboratory	280	6	4			
Contingencies	88	8	5			
				3,010	0	0
VI. *Estate Improvements of a Permanent Character.*						
Repairs to buildings, &c.	803	5	5			
Re-thatching cattle shed at Model Farm	108	1	3			
Constructing field roads and repairs to similar roads	434	14	0			
Water channels	379	11	4			
Deepening wells	23	10	0			
Sub-soil and surface drainage	627	10	7			
Trees and planting	135	0	0			
Levelling and reclaiming land on the banks of the river	166	15	0			
Levelling the surface of dry crop land brought under wet cultivation, &c.	1,942	11	7			

* Includes salary of the Assistant to be placed in charge of the Coimbatore District Farm.

	Rs.	A.	P.	Rs.	A.	P.
Re-gravelling road at Model Farm	150	15	10			
Contingencies	83	3	6			
				4,856	2	6
Total ...				41,390	14	10

INCOME OF THE MADRAS AGRICULTURAL DEPARTMENT.

Balance on hand as per Accountant General's Books ...	1,75,975	14	7			
Special Grant	25,000	0	0			
Receipts from the Surplus Pound Fund during 1874-75 ...	56,756	6	9			
				2,57,732	5	4
I. *Madras Experimental Farm.*						
Fruits, vegetables, &c.	136	9	1			
Fodder, &c.	45	5	7			
Rent, &c.	1,446	11	5			
Cattle	27	4	0			
Pigs	227	2	4			
Sheep	261	4	0			
Poultry, rabbits, &c.	78	10	0			
Grains, seeds, &c.	492	6	10			
Indigo and cotton	84	11	8			
Machines, &c.	111	10	9			
Sundries	698	2	8			
				3,609	14	4
II. *Madras Model Farm.*						
Fruits, vegetables, &c.	568	2	11			
Fodder, &c.	150	1	10			
Cattle	85	0	0			
Pigs	344	0	11			
Sheep	132	3	5			
Poultry, rabbits, &c.	84	1	0			
Grains, seeds, cotton, &c.	265	9	9			
Sundries	345	7	10			
				1,974	11	8
III. *Implement Worksheps.*						
Machines	792	4	6			
Materials, labor, &c.	1,451	7	3			
				2,243	11	9
Total ...				2,65,560	11	1
Balance in favor of the Madras Agricultural Department on the 1st of April 1875				2,23,405	2	3

VALUATION of Live and Dead Stock belonging to the Sydapet Experimental Farm on the 31st of March 1875.

	Rs.	A.	P.	Rs.	A.	P.
Cattle—						
5 Bulls						
18 Bullocks	...	...	...	1,485	0	0
1 Cow						
2 Calves						
Sheep—						
24 Rams						
59 Ewes	...	...	...	883	0	0
32 Gimmers						
53 Lambs						
Pigs—						
8 Boars						
13 Sows	...	...	...	429	0	0
2 Geldings						
3 Young Pigs						

| | | |

Seeds supplied gratis during 1874-75.

Date.	To whom supplied.	Maize.	Cotton.	Carolina Paddy.	Yellow Cholum.	Sorghum Saccharatum.
		lbs.	lbs.	lbs.	lbs.	lbs.
12th May 1874.	R. Ragoonatha Row, Mylapore	10	4	25	10	...
15th „ ...	Doctor Shortt, Shevaroys	...	...	10	...	5
11th June ...	Jaya Row, Madura...	10	20	...	...	...
12th „ ...	C. Rajoo Moodelliar	...	...	10	...	...
„ ...	Najeemodien Saib, Sydapet	5	...	...	...	...
15th „ ...	Ramachendra Row...	10	10	10	...	10
7th July ...	K. Rungasawmy Naidu, Sydapet ...	3	3	...	...	3
„ ...	P. Valayutha Naick, Madras	5	5	5	...	5
16th „ ...	Mr. R. W. Weld, Mayaveram	5	30	15	...	5
17th „ ...	Mr. R. W. Barlow, Chingleput District...	...	...	6	...	1
24th „ ...	Doctor Cornish, Madras	2	...	...	...	3
25th „ ...	Abdoor Kuzzar	5	5	10	...	...
28th „ ...	The Coimbatore Municipality	20	10	...	...	5
31st „ ...	Mr. Mackenzie, Nellore	10	5	...	...	5
3rd Sept. ...	The Badagas, Kaity Valley	5	10	...	5	5
„ ...	Rajoo Chetty, Sydapet	...	...	9¼	...	...
10th „ ...	Moothealoo Chetty, Sydapet	10	10	10	...	5
26th „ ...	Mr. A. D. Lister, Shevaroys	5	...	...	...	2
7th Oct. ...	Captain E. Campbell, Dindigul	10	5	...	...	...
8th „ ...	Bashyam Iyengar, Mylapore	10	10	..	10	5
„ ...	Appavoo Naick, Chingleput	15	...	15	10	...
28th „ ...	Mr. Thomas Stanes, Coonoor	...	...	...	10	10
6th Nov. ...	Ramiah Pillai, Sydapet	5	...	10	...	...
19th „ ...	Bashyam Iyengar, Mylapore	...	...	...	10	...
26th Feb. ...	The Government of Bengal	...	...	150	...	...
	Total ...	145	127	285¼	55	69

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st *April* 1875.

1 Chaff-cutter and universal mill, with bullock power, by Messrs. Ransomes and Sims.
1 Threshing machine, with bullock power, by Emery Brothers.
1 Threshing machine, by Dray Taylor & Co.
1 Threshing machine, with bullock gear and carriage, by Ransomes and Sims.
1 Threshing machine, with bullock gear and carriage by Garret & Co.
1 Winnowing machine, by Garret & Co.
1 Winnowing machine, by Dray, Taylor & Co.
1 Winnowing machine, by Ransomes and Sims.
1 Winnowing machine, by Hornsby and Sons.
1 Winnowing machine, by Smith & Co.
3 Reaping machines, by Samuelson & Co.
1 Drill sowing machine, 8 rows, by Garret & Co.
1 Cylindrical corn screw by Ransomes and Sims.
2 Ploughs by Ames & Co., Boston.
1 Turn-wrest plough and yoke, by Ransomes and Sims.
1 Stone roller.
2 Drill sowing machines, 13 rows, by Garret & Co.
1 Wood drag harrow, by Experimental Farm
2 Iron chain harrows.
4 Bullock hoes.
1 Bullock plough, by School of Arts.
1 Bullock plough, by Mint.
2 Bullock ploughs by Ransomes and Sims.
1 Double mould board plough.
1 Large plough, with two wheels, by Ransomes and Sims.
1 Swing plough, by Roorkee Workshop.
2 Wet land ploughs, by Experimental Farm.
1 Wooden roller.
1 Four-wheel waggon.
1 Stone trolley.
1 Root-pulper, by Ransomes and Sims.

2 Sets of iron harrows, with swingletree, by Ransomes and Sims.
3 Country carts.
2 Water carts.
1 Sewage cart, by Gun Carriage Works.
1 Maize sheller, by Ransomes and Sims.
1 Drain-pipe making machine.
1 Barrow drill, by Experimental Farm.
1 Rain guage.
1 Water elevator, by Burges and Key.
1 Water elevator, by Mint.
2 Water elevators, by Experimental Farm.
3 English ladders.
1 Norton's tube well with a rotary motion.
1 English grindstone.
1 Farm bell.
2 Wheel hand-hoes.
14 Cattle yokes.
2 Single bullock carts.
1 Overhead, bullock power, with shafts and gearing.
1 Californian pump.
1 Archmedian pump.
1 Cake-crusher.
1 Two-wheel plough with cultivator, by Ransomes and Sims.
1 Pump, by Roorkee Workshop.
1 Combined mill and oil-cake breaker, by Ransomes and Sims.
1 Chain pump, manual-power.
1 Chain pump, bullock-power.
1 Large platform weighing-machine.
1 Large beam and scales.
1 Cotton gin, by Gordon & Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
1 Country cotton gin.
8 Cottage cotton gins.
2 Cotton gins, by Burges and Key.
1 Hand broad-cast sowing machine.
5 English carts.
1 Malabar spoon bale.
2 Waterproof cart covers.
1 Sack-barrow.
1 Portable scale with weights.
3 Picottah buckets.
4 Leather buckets with ropes and gearing for double mhote.
1 Large wheel-barrow.
13 Wheel-barrows.
3 Hay frames for carts.
1 Hand cart.
1 Sub-soil plough.

3 Clocks.
14 Tables.
14 Chairs.
2 Writing desks.
5 Almirahs.
2 Iron cash chests.
3 Book-cases.
1 Dynanometer.
1 Surveying level with stand staves, &c.
Set of bottle levels, chemical apparatus, mortars and pestles, glass beakers, &c.
20 Feeding tubs.
5 Metal feeding troughs.
1 Scythe.
1 Manure drag.
2 Bengal picks.
2 Dutch hoes.
20 Hoes.
3 Hatchets.
2 Hand-barrows.
7 Iron rakes.
35 Mamoties.
1 Large field rake.
13 Crowbars.
16 Picks.
2 Mattocks.
5 Forks of sorts.
1 Horse hoe.
6 Shovels.
4 Bill hooks.
1 Iron real.
10 Grass knives.
4 Manure forks.
14 Digging forks.
4 Sets of bullock harness.
2 Surveying chains with pins.
2 Iron cisterns.
91 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Ear punch for marking sheep.
1 Mercal, one half-mercal, and one measure.
1 Weeding spud.
3 Pairs of sheep shears.
1 Dibble.
6 Spanners.
5 Mallets.
5 Rammers.
2 Hedge shears.
1 Poultry feeding cage.
1 Maize cob-stand.
2 Driving wheels.
1 Large rubbish screen.
1 Drain scoop.

1 Lactometer.
1 Single barrel fowling piece.
1 Pair of pan scales.
1 Branding iron for marking sheep.
1 Theodolite.
2 Sickles.
1 Chester measure metallic tape, 66 feet.
10 Levelling boards.
1 Screening die, two pipe dies, one hollow brick die, eight brick moulds, one rake for furnace, and one poker.
1 Screw jack.
1 Hoe fork.
1 Leather bucket.
7 Wooden troughs.
1 Hand screen.
1 Cross staff.
3 Iron cots.
3 Country ploughs of different patterns.
3 Benches.
4 Large hand hoes.
1 Small hand hoe.
1 Heavy hatchet.
1 Knife.
4 Reaping knives.
2 Draining spades.
1 Country plough from Napier Foundry.
1 Country reaping knife.
1 Lantern.
1 Pruning knife.
1 Rabbit box.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1st of April 1875.

3 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
2 Country carts.
1 Box cart.
6 Reaping hooks.
8 Picottah buckets.
1 Chopper.
20 Feeding tubs.
3 Small wheel-barrows.
6 Digging forks.
7 Yokes.
8 Planters' hoes.
1 Tub for well.
1 Scythe.
1 Weeding spud.
1 Tarpaulin.
1 Measure.
1 Half-mercal.
1 Scale triangle, weights, &c.
2 Spades.
1 Large beam and cattle-weighing scale.
9 Fifty-six pound weights.
26 Plough-shares.
1 Table.
1 Hay fork.
1 Mamoty.
1 Pair pincers.
1 Turn-screw.
1 Chisel.
1 Gimlet.
1 Triangle with beater.
1 Water cask.
1 Hand saw.
1 Hatchet.
1 Cold chisel.
2 Mallets.
1 Chaff cutter.
1 Lantern.
1 Steel.
1 Drag harrow.

List of Tools, &c., belonging to the Implement Workshops on the 1st of April 1875.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
18 Tongs.
3 Bellows.
2 Screw plates.
4 Sledge hammers.
6 Small hammers.
6 Chisels "Smith's."
8 Punches.
1 Countersinking punch.
5 Dies or flat chisels.
2 Pairs of calipers.
1 Iron square.
2 Round files.
3 Half-round files.
2 Flat files.
22 Taps for screw plates.
1 Iron brace and 8 bits.
1 Filer's hammer.

1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
1 Square file.
1 Angular file.
1 Bob drill.
2 Screw liners.
1 Bench with 2 vices.
3 Hand saws.
1 Pit saw.
1 Cross-cut saw.
5 Augers.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
8 Carpenters' chisels.
1 Cold chisel and 2 chisels.
2 Set squares.
1 Angle square.
3 Gimlets.
1 Brace with 36 bits.
2 Adzes.
1 Hammer.
2 Turn-screws.
1 Plummet.
4 Saw files.
4 Rasps for wood.
1 Mallet.
1 Pair scales.

List of Books added to the Apprentices' Library during 1874-75.

Catalogue of Agricultural Implements.
Indian Journal of Science.
The Principles of Chemistry, by Dr. Julius Adolph Stockhardt, 1852.
Elements of Mechanism, by Thomas Tate, 1859.
The Conchologists' Text Book, by William Maggillinray, Esq., 1853.
Natural Production of Burmah, by Rev. Francis Mason, A.M., 1850.
Elements of Chemical Analysis, Qualitative and Quantitative, by Edward Andrew Parnell, 1845.
The Physiology of Common Life, or the Science of Health, by John Scoffern, M.B, London, 1857.
Elementary Introduction in Chemical Analysis, by Dr. C. Renugins Fresenius, 1853.
A Journey from Madras through the Countries of Mysore, Canara, and Malabar, by Francis Buchanan, M.D., 3 Vols., 1807.
Humboldt's Cosmos, by Alexander Von Humboldt, 4 Vols.
Zoology for Schools, by Robert Patterson, 2 Vols., 1848.
A Manual of the Nellore District, in the Presidency of Madras, by J. A. C. Boswell, M.C.S.
Allen's Catalogue of Agricultural and Horticultural Implements.
A Catalogue—Fat Cattle.
The Journal of the Royal Agricultural Society of England, Vol. X., Part I., 1874.
Do. do. do. do. do. Vol. X., Part II., 1874.
Do. do. do. do. do. Vol. IX., Part II., 1873.
Manual of Physical Research adapted for India, by George Buist, L.L.D., &c., Part I., 1852.
A Manual of Chemistry, Inorganic and Organic, by T. Key, Esq., 1852.
The Culture of Cotton in India, by J. Forbes Royle, M.D., F.R.S., 1851.
Introductory Text Book of Meteorology, by Alexander Buchan, M.A., F.R.S.E.
Indian Postal Guide for 1874.
Asylum Press Almanac for 1874.
The Horse, by William Yonatt, 1843.
Treatise on Geology, by Professor John Phillips, F.R.S., 1838.
Our Home Islands, by Rev. Thomas Milner, M.A., F.R.G.S.
Physics, by Professor Balfour Stewart, 1872.
Mensuration for Beginners, by J. Todhunter, M.A., &c., 1871.
Foods, by Edward Smith, M.D., &c.
The Reason Why—Natural History.
Asylum Press Almanac for 1875.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST OF MARCH 1876.

MADRAS:
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FOR THE

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GENERAL.

TOURS.

1. In Government Order, No. 1,550, dated the 1st November 1875, I was directed to undertake a tour through the Coimbatore District, in view to collecting information regarding its agriculture.

THE COIMBATORE DISTRICT.

AREA, AGRICULTURAL HOLDINGS, POPULATION, &c.

Large area of ryotwary land paying no revenue.

2. The area of the District is 7,432 square miles, of which 1,298 square miles consists of Government Forests, hill tracts, waste land and, permanently-assessed properties; the remainder, 6,134 square miles, or, 3,925,760 acres is Government land under Ryotwary tenure but, of this, rent is paid only for 2,200,000 acres, leaving 1,725,760 acres of ryotwary land, from which no revenue whatever is derived.

3. The occupied area is held under 215,207 ryotwary leases, as below ;—

Rent.	In 1871-72.	
	Number of Leases.	Total Amount.
Below 10 Rupees ...	142,455	7,07,299
From Rs. 10 to Rs. 30 ...	57,138	9,00,995
„ „ 30 to „ 50 ...	9,602	3,49,068
„ „ 50 to „ 100 ...	4,628	2,97,774
„ „ 100 to „ 250 ...	1,199	1,66,558
„ „ 250 to „ 500 ...	152	48,340
„ „ 500 to „ 1,000 ...	26	18,119
Above 1,000 Rupees ...	7	11,182
Total ...	215,207	24,99,335

From the foregoing, it would appear that, the average rent of a holding is about

Average holding about 12 acres.

Rupees 11½ per annum ; as, the average rent over the whole district is, about 15 annas, per acre, one of these holdings will be about 12 acres in extent. It will be seen that there are a considerable number of good sized holdings, thus ;—

9,602 holdings, each of an area between 30 and 50 acres.
4,628 holdings, each of an area between 50 and 100 acres.
1,199 holdings, each of an area between 100 and 250 acres.
152 holdings, each of an area from 250 to 500 acres.
33 holdings, each above 500 acres in extent.

4. It is true that in some instances a holding may be held in a joint tenancy by two or more persons but, on the other hand, several of the smaller holdings may be held by one person.

5. At the last Census in 1871 the population of the district was 1,763,274, or 237·3 per square mile consisting as follows :—Hindoos 1,715,081 ; Mahomedans 36,026 ; Christians 12,067 ; others 100. Of Europeans and Eurasians there were only 595 in the whole district. Of the entire population, 942,555 persons were classed as Agricultural. Of the 537,000 males entered in the occupation lists, 256,130 were cultivators and 138,679 were laborers ; of the latter, three-fourths were employed in connection with land. It will be noticed that there were about 40,000 more persons classed as cultivators than there were ryotwary leases ; it is probable that many of these are tenants on the Zemindary and Inam lands and, sub-tenants holding land under other ryots, on the share system. The population of the district in 1851-52 was 1,153,862, but this included about 20,000 persons who inhabited the Neilgherry Hills, deducting these, the population of Coimbatore was in 1851-52 1,133,862 ; the increase in the population in the last twenty years was thus 629,412 persons, or, 55½ per cent.

Great increase in the population.

ROUTE ; METHOD OF CONDUCTING THE ENQUIRY, &c.

6. I began the tour at Pothanore on the morning of Thursday the 13th of January. From Pothanore I passed on to the town of Coimbatore, where I remained for some time. During the halt I was employed in inspecting, the land, in the vicinity watered by wells and by the Noyel River ; the Jail Farm ; the Municipal Gardens, &c. &c. On the 27th I left Coimbatore for Mettapollium ; on my way, I stopped at Goodaloor, from the evening of the 27th to the morning of the 1st of February, and visited several of the neighbouring villages, amongst others, Goundenpollium and Naickenpollium. I reached Mettapollium on the 1st of February and remained there, until the 7th, engaged in inspecting the neighbouring country and the land on the banks of the Bhowany, both to the east and west of Mettapollium ; I also, at the same time, inspected the Coffee Estates situated at the foot of the Coonoor Ghaut, and, the cultivated land around Kullar. From Mettapollium I passed on to Annur, which place, I reached on the 8th. During the two days I was at Annur I visited, Vadakaloor, Varapollium and Maitupollium. On the 11th I reached Avenashy, where I camped until the 18th.

While at Avenashy, I inspected the cultivated land in its vicinity and, made several short tours. On the 18th I started for Sattiamangalam Taluq. After seeing the cultivated land in the neighbourhood of Sattiamangalam and visiting several villages situated within a few miles, I left that place, on the 22nd, for the Town of Bhowany. On my way to Bhowany, I camped for short time at Gopichettypollium. I remained at Bhowany until the 2nd of March, and inspected the wet land situated on the banks of the river, as well as, the land watered by the Bhowany channel; and visited several villages to which only "dry" land is attached. On the 2nd of March, I started for Caroor camping at Chavadypollium, Malayampollium and, near the Noyel River, on my way; as, this route followed very closely the Calingaroyen Channel, I had ample opportunities of seeing the cultivation dependant on it. I reached Caroor on the 4th of March, and while there, inspected the land, watered by the Cauvery Channel, and, by the Ambravutty, and, visited Nerur, Andankovil, Punjamathavy and other places. On the 11th of March, I left Caroor for Kongiem, and camped on the way, at Paramathy, and, at Vellakovil; from Kongiem I visited Koundenpollium, Papireddypollium, Siven Malai and some other villages. On the 17th I left Kongiem for Darapuram, and halted at Oothioor. When at Darapuram I visited, Colinjivady, Nilambur, Nunjiampolliem, Alengiam, Condrasanpollium, Punjaputty, Ooppar, Varapollium, &c., and gave much time to an inspection of the land watered by the Ambravutty. On the 28th I started for Oodumulpett, on the way I halted at Thalavoypattanam, at Karathoolavoo, and at Thoengavy. From Oodumulpett, I visited Bodipatti, Chinnaveerumpatti and some other villages. On the 31st I left Oodumulpett for Pollachy; and halted at Gomungalam and at Thippumpatti. When at Pollachy I visited Vadugapollium, Auliar, Palaur, Cotampatti and other villages. I left Pollachy on the 5th of April for Pothanore and stopped at Sunthagoundenpollium, at Kanathoocadoovoo; and, at Othikkalmundapum, at the latter place I inspected a site for the District Experimental Farm. While at Pothanore, I inspected another site which had been selected by the Collector for a District Farm, and I again inspected the land in that neighbourhood watered by the Noyel River; on the 11th of April, I returned to my head-quarters, at Madras.

Made almost an entire circuit of the District.

7. It will be seen that I made almost an entire circuit of the District. I saw something of all the Taluqs excepting Collegal which, I found it impossible to visit, without delaying my tour in the southern and more important parts of the District until, too late in the season. Though, unable to visit Collegal, I met the former Tahsildar of the Taluq who, favored me with much valuable information regarding its agriculture.

Method of conducting the inquiry.

8. The whole of my travelling was performed during daylight, so that, I was enabled to see the country and inspect everything of interest I, usually, camped for a few days in places that appeared suited as centres from which to inspect the neighbouring land, and from these, I made short tours into the surrounding country. The distance apart of these observation centres varied from 15 to 30 miles. I usually visited the ryots at their villages; the inspection of the land belonging to these villages was performed

in company with as many of the ryots as chose to accompany me. During such inspections various topics were discussed bearing on the condition of the country around, the agricultural practice of the locality, &c. In some places, the Ryots came in large numbers to my camp. I did not trust alone, to the information I collected at these gatherings but, availed myself of the frequent opportunities afforded, while passing through the country, of picking up facts from the ryots, whom I found engaged in the fields.

GENERAL APPEARANCE AND STATE OF THE COUNTRY.

Landscape very bare.

9. Around the principal towns the country is usually well wooded and all the chief roads are bordered by trees; but throughout the Dstrict, generally, the landscape is exceedingly bare. In some places the rich growth of vegetation on the land irrigated by rivers and wells, forms a redeeming feature in the landscape, however, the amount of land under the influences of irrigation forms but an exceedingly small proportion of the whole area. I was surprised to find the banks of the chief rivers almost without trees. The Bhowany, a few miles above Mettapollium has some fine trees growing near it, but these are confined chiefly to the lower portions of the valley, the higher slopes are generally covered only with low growing bushes, chiefly acacias; further down between Sattiamangalam and the town of Bhowany the banks of the river are almost bare; the banks of the Ambravutty, of the Noyel, and of the Cauvery are equally destitute of trees. Most of the large jungle streams have on their banks narrow fringes of scrub jungle, but it is rare indeed that any good trees are met with in such situations. I saw but little natural forest during my tour, excepting that, growing on the slopes of the Annamalay and the Neilgherry ranges. Of dense jungle, I also saw but little; I passed through several of the so-called jungles, but they are so exceedingly open a horseman could ride through them in almost any direction. These jungles consisted chiefly of acacia bushes scattered apart at wide intervals over the ground; the undergrowth is apparently kept in check by the cattle and goats of the ryots living in the neighbourhood; of pasturage, there is but little in these jungles, the grasses chiefly met with being coarse reedy varieties, useless as fodder except, when quite young. These jungles, would undoubtedly have been cleared long ago had the land possessed any value. A much worse description of jungle and one, which occupies far too extensive an area in this District, is that formed of the prickly-pear. In some places energetic measures appear to have been taken to annihilate this pest but, there are still large areas of land covered by it. Much good agricultural land has been rendered temporarily useless from having been taken possession of by the prickly-pear. Ryots have done much to spread this troublesome pest by using it in so many instances for fencing purposes. In some parts of the district the fields are divided by belts of prickly-pear sometimes of many yards in width. It has been denied that the ryots ever plant the prickly-pear for fencing purposes, but I saw during my tour many newly formed fences, and others, in all stages of growth.

Large areas of land covered by prickly-pear.

Again and again I pointed out to the ryots the serious mistake they were making in allowing so much useful land to remain covered by this pernicious plant, but they seemed not to recognize the evil that arose therefrom though, when advised to plant trees for the supply of fuel for their own use, they invariably expressed, how glad they would be to do so, could they but obtain the necessary land, and yet, many of them had land growing prickly-pear that would have sufficed to provide all the fuel they ever could require for their ordinary domestic wants. But the overgrowth of prickly-pear is not confined to agricultural land, but extends to much of the waste land within and bordering many of the villages; growing under such circumstances it cannot but be highly pernicious to health, especially as the ground under prickly-pear is, in such situations, the refuse depôt of the village. In some places, the ryots excused themselves for having large belts of prickly-pear around their fields, on the ground that they would not be permitted to remove these belts as, they formed demarcation lines or boundaries but, I have reason to believe that if, the ryots were really in earnest in a desire to get rid of the prickly-pear that, they would experience no difficulty on the ground advanced. I was sorry to observe in many parts of the District that those entrusted with the management of the roads are blamable to some extent for the extension of the prickly-pear nuisance. On some of the roads for miles on either side at intervals of from 10 to 30 yards, I saw pits which had been dug in excavating road gravel which are now full of luxuriant prickly-pear. Many of these pits being situated so close together the intervening land cannot be tilled and this, in time, becomes covered with prickly-pear by the spreading of the plants growing in the pits. It seems a great pity to have agricultural land disfigured and injured by these gravel pits; to many of these roads, margin drains would be of great service for carrying off water after heavy rain and, there would be no practical difficulty, in most instances, in obtaining the material needed for road repairs by cutting these drains, as the material appears to be met with, generally, very near the surface.

Prickly-pear occupies land that might produce fuel trees.

Old gravel pits often are prickly-pear nurseries.

10. The general absence of plantations of fruit or fuel trees and the almost complete absence of trees in the ordinary villages shows how very unenterprising are the people. Of the occupied area, 2,200,000 acres, there are only 5,000 acres under plantations of this sort. It is true that, the climate of Coimbatore is not particularly favorable to the growth of trees but, there are no difficulties to be encountered that cannot be overcome by the expenditure of a little labor which, it would be in the power of most ryots to afford, seeing that, it would be chiefly demanded of them at the season of the year when they have but little work to do in their fields. Near the towns of Coimbatore, Darapuram, Bhowany, Caroor, and one or two others, there are many trees of very large growth; the mango trees especially at Bhowany and Darapuram were very fine. The production of trees over the District is, I think, essential to the well-being of its agriculture.

Good trees are produced in the District.

11. As a beginning, in Tree Planting, Government might establish a number of Camping Topes, in different parts of the District, such topes should be situated

at about 10 miles apart along the principal roads, and each should be provided with a well. These topes would afford hints to the ryots, in tree planting, and if, placed under the charge of the officers of the village to which the land was attached the expense of maintenance would be trifling; the topes would be remunerative in time, in the fruit rent, from the proceeds obtained for fuel, and, the camping fees. In many parts of the District there are no Public Bungalows and, in other parts, the Public Bungalows have been rented for private occupation. I found tent-life almost unendurable in the months of March and April when, the tents had to be pitched in open ground exposed to the full glare of the sun. In some places I had no choice but to pitch my tents on the road-side, in order to secure such shade as the road-side trees afforded.

12. It is generally asserted by the ryots that during the past 30 years an immense area of land which, was covered with trees and bushes of a jungly growth, has been cleared, partly in view to the extension of arable culture and, partly to afford fuel, for the railways, and, to meet the largely increased domestic demand. I was shown large tracts of country which, the people declared was under jungle only 20 or 30 years ago.

Large areas of land cleared and brought under the plough during the past 18 years.

13. It is certainly the fact that, *upwards of* 700,000 *acres of land which was growing jungle scrub and coarse grass has, during the past* 18 *years only, been brought under the plough*, and this, must have influenced the climate of the District, seeing that the land thus brought into cultivation is perfectly bare during two-thirds of the year. The people were unanimous in stating that the rainfall had been gradually diminishing during the last 20 or 25 years, in some places they appeared to connect this diminution in the rainfall with, the denudation of the country, though this, was the case only in occasional instances. The evidences brought forward of the smaller rainfall during the last few years in comparison with that of the earlier part of the period before mentioned consisted chiefly of facts relating to the flow of certain jungle streams. I was shown streams which now cease flowing invariably before the end of December that, 20 or 30 years ago were said to have flowed regularly up to the end of February. This matter I think, demands the serious attention of all interested in the welfare of the country.

Gradual diminution of rainfall.

The flow of streams good evidence of rainfall.

14. I am aware that it is asserted that the rain registrations made during a great number of years, in this Presidency, show no perceptible diminution in the rainfall but, if this is the case, it must be remembered that, these rain registrations have been made for a long period, only at a very few places; that, until lately the rain gauges used were imperfect, and the observers, untrained; and that, the localities in which these registrations were made were, generally, well wooded, being in most instances the Head-quarters of a District. *Rain Registrations made in a well wooded part of a District are not likely to show the effect produced by the denudation of another portion* 20 *or* 30 *miles distant.* It is well known how greatly the fall of rain is

Rainfall registrations made in a wooded part of the District not applicable to whole area.

influenced by local conditions. At Sydapet, the rainfall differs from that registered at the Madras Observatory, though, the distance between the two places is only five miles.

15. On most occasions when I met an assembly of ryots I directed attention to the great importance of tree planting, in view to, the production of fruit and of fuel, the improvement of the climate and, the protection of live-stock by affording shelter during severe weather, &c. But though, the people generally agreed with me in the views I expressed, they evinced but little desire to carry them into effect. In one place, after addressing a large assembly of ryots under the shade of a tree, I was informed by a ryot and, the rest appeared to agree with him, that trees would not grow in that locality, I immediately asked what had caused the tree to grow under which we were then standing, and they replied that, "it had come by itself;" as, the tree was bearing seed, at the time, I advised them to collect the seed and to plant it with due care, under the necessary conditions to ensure germination but, they protested that, it would be quite useless to sow the seed for, "the tree only came by itself."

Great ignorance regarding tree culture.

16. I am convinced that if proper means were taken, there would be no difficulty whatever, in clothing with trees, the greater part of the District where trees are needed but, to produce this result, the ryots living in these places must be distinctly informed that, they must plant and rear a certain number of trees for each acre of land under occupation, or, that, the State will plant and rear the trees at the expense of the ryot. If, the State is bound to support the ryot during famine seasons, it certainly has a right to expect that he will take such precautions as are in his power to make these famine seasons as less frequent as possible. On two or three occasions when discussing this question at ryot gatherings, the people said that, if Government ordered them to plant and rear trees that they would do so. It would, I think, be doing a kindness to the people to compel them to plant a certain number of trees on all their holdings, where trees are needed, the trees, of course, to be the property of the people who plant and rear them but, restrictions to be laid down as to felling, &c. The trees need not interfere to any extent with the area of land under cultivation. There is all over the District where trees are needed, sufficient waste land to produce the trees required. In speaking of "waste" land I do not use the word waste as it is understood in the Revenue classification but, in its ordinary sense; there is a very considerable area of the so-called cultivatable land which is, to all intents and purposes, waste and which might be cropped with trees.

The State should compel the ryots to grow trees.

Land available for growing trees without interfering with arable land.

17. I have mentioned that the landscape of the District is exceedingly bare but this, conveys but an imperfect impression of the actual appearance of the country. In the unirrigated tracts there are but few spots on which the eye can rest with pleasure. From rising ground in many places no tree can be seen for miles, excepting perhaps, those bordering a chief road. Much of the arable land is lying untilled, temporarily abandoned, and

Country very bare.

this land has a very untidy appearance from the bushes and tufts of wild vegetation which, spring up on it. In passing through the country I looked in vain for those evidences of enterprise, and industry which are supposed to be characteristic of small farming. Everywhere, were evidences of neglected opportunities. In Ireland, when on a tour of a kind somewhat similar to that I am now referring to, I was frequently shown most satisfactory evidences of what can be done by peasant cultivators, towards the improvement of land; again and again, I saw improvements which could have been effected at a moderate cost, by no other means, and which, were amply repaying the enterprising people who had made them; and, similar experiences are common in most European countries. The ryot, in his management of land, falls far short of the peasant cultivator of most other countries.

No evidence of enterprise and industry.

18. I do not lose sight of the fact that in some places, the ryot has done a good deal more for the land than, merely to perform the acts of cultivation, the wells have, I am aware, been sunk entirely at the expense of the ryot; and, the terraced land under irrigation has, also, been laid out at his cost but, the total area of land in this District, influenced by these improvements, is not 200,000 acres leaving 2,000,000 acres of occupied land altogether untouched by such improvements. It has been said that a peasant cultivator, when holding land on a secure tenure, will convert a wilderness into a garden but, that, such is not always the case, is amply evident from the condition of much of the agricultural land in this District. I have long held the opinion and, my experience in this country has amply verified it that, security of land tenure alone, will not suffice to ensure good farming.

Wells sunk and irrigatable land laid out at the cost of the ryot.

19. The condition of most of the agricultural villages, is very unsatisfactory. In most civilized countries the village is associated with all that is healthful and pleasant but, the majority of the villages I passed through during my tour, are characterized by conditions quite the reverse of these; and this, was specially noticeable after my brief sojourn in the town of Coimbatore, the sanitary state of which has reached such perfection. Not only do most of the villagers live in wretched hovels in which, it is almost impossible that, good health can be secured but, from the untidy and dirty habits of the people, everything around these hovels tends to the production of ill-health. I am aware that many of the inhabitants of these villages have nothing to spend further than suffices for bare existence but, I am also aware that, most of these people have during the long dry season, a great deal of unoccupied time at their disposal which, it might, reasonably, be expected, they would utilize in improving their dwellings, and the state of the surrounding ground. If, it is true, and, I have every reason to believe that it is, that the working members of these village communities lose, on the average, in the year, from four to six weeks' labor earnings, from sickness, produced by the bad sanitary conditions of these villages the people, would have great cause for thankfulness if, some measures could be devised, by the employment of sanitary police or other means, which, would ensure

Bad sanitary state of the villages.

The villagers have plenty of time at their disposal.

better sanitary conditions. I speak thus of the villages from a very unpleasant personal acquaintance with many of them. In passing through the country, especially in the early morning one of the first indications that we were approaching a village was, a sickly odour of decomposing excreta. I consider that the bad sanitary conditions of most of the villages is, *a great agricultural evil.* From the sickness that results, the people do not enjoy that robust health which, is so essential for the proper performance of out-of-door agricultural duties and, frequently they are incapacitated for physical exertions, at the most important agricultural season of the year.

Working classes heavy losers from sickness.

20. I camped near, and, passed through, many villages in which, it was impossible to obtain any water fit for drinking. In many of these villages the chief water-supply for the inhabitants was a tank-well which, derived its water chiefly from the drainage of the surface excreta-saturated-land adjoining, whenever the rainfall was sufficiently heavy. Surely, in regard to the improvement of the water-supply for drinking purposes, something can be effected; if, the people cannot afford to pay the cost of making any needful improvements, they can themselves, at any rate, afford the labor. Each villager had better work for one week in the year, in aiding in the improvement of the sanitary condition of the village, than that each working villager should lose from sickness, at least from four to six weeks' wages in the year, and have his or her constitution undermined.

Villages badly supplied with drinking water.

21. The villages to which irrigated land was attached were in most instances, much superior to those just referred to. Not only were the dwellings larger and more substantial but, they were much more tidy and cleanly; however, these villages are but very few in number, in comparison with the number of villages in the district.

22. As far as could be learnt from observation, the people, generally, in the unirrigated parts of the district appeared to possess but few resources, upon which to fall back in times of scarcity. The stack-yards of villages to which wet land is attached were, generally, well filled; but, in the unirrigated parts of the country, I frequently travelled for miles without seeing a stack of any sort and, it must be remembered that, at the time of my tour, a very considerable proportion of the cereal crops had just been gathered. However, judging from the appearance of the crops that were then standing, it would require the produce of many acres to make a decent-sized stack.

Few resources for dependance in times of scarcity.

23. The general opinion I formed of this district was very different from the opinion I held of it before going on the tour. I had frequently passed on the Railway through the portion of the district between Erode and Mettapollium and, I had also travelled along the line between Erode and Caroor; and, from what I had then seen, it appeared to me that the District was a flourishing one from an agricultural point of view, however, I now know, that the Railway line passes through some of the most favored portions which, are irrigated by the perennial rivers, Bhowany and Noyel. Between Erode and Caroor, the Calin-

Observations made of a country from a Railway carriage misleading.

garoyen Channel accompanies the Railway line almost the entire distance and, near Pothanore the water of the Noyel Channel, on the fertile land in the neighbourhood, produces a most luxuriant vegetable growth. Observations made of a country from a Railway carriage, when travelling at the usual speed, are often most misleading. I was particularly struck in regard to this, from having an opportunity of afterwards examining, in the fields, some of the crops which, I had seen from the Railway train when going to Coimbatore from Madras. Not only do the crops appear much better than they really are but, the area under crop seems much greater than it really is; patches of irrigated land of two or three acres in extent, are seen and noted and, the impression dwells in the mind while, hundreds of acres of untilled waste pass unobserved.

THE FARMING OF THE LAND IRRIGATED BY RIVERS, AND TANKS, &c.

Irrigated land but a small proportion of the district.

24. In the Coimbatore District, irrigated land forms only about 4 per cent. of the land under cultivation but, it pays one-quarter of the entire land revenue of the district. The average rent derived from this irrigated land is about 7½ Rupees per acre, whereas, the average rent of the dry land under cultivation is only about 14½ annas per acre. The total area of land in this district, irrigated by means of rivers and tanks is 106,187 acres, of this 10,490 acres is Inam land, and 7,075 acres is waste; the area of Government land under culture is only 88,622 acres. The following shows the irrigation sources;—

	Area, Acres.
The Cauvery River	4,158
„ Bhowany River	25,679
„ Ambravutty River	21,056
„ Auliar River	4,243
„ Noyel River	14,904
„ Jungle Streams	5,779
„ Rainfed Tanks	12,803
Total ...	88,622

25. I gave much attention to the chief rivers of the District. The Bhowany, I met with first at about ten miles to the west of Mettapollium, and I followed it down to several miles to the east of that town; I again met with it at Sattiamangalam from which place I followed it to the town of Bhowany where, it joins the Cauvery. From Bhowany I followed the Calingaroyen Channel down to the Noyel River about twelve miles to the north-west of the town of Caroor. I saw the Cauvery at Bhowany and again near Nerur. At Caroor I met with the Ambravutty which, I followed for some distance; I again travelled along its banks in the Darapuram Taluq. The Noyel river I saw, near the town of Coimbatore, at Payrur at about six miles to the south of Avenashy, and again, where it joins the Cauvery. The Palaur and Auliar rivers, I met with at the foot of the Annamalay Hills a few miles to the south of the town of Pollachy. At the time of my tour the

Bhowany, and the Cauvery were the only rivers in which there was a moderately good flow of water. The Noyel river was flowing only for a short distance beyond Payrur; lower down, at another place where I saw it, about six miles to the south of Avenashy, the bed of the river was dry in many places while, at its lower end near the Cauvery there was no water whatever. The bed of the Ambravutty near Caroor was dry but, further up near Darapuram and as much further up as I went, there was a small flow of water. The beds of the Palaur and Auliar rivers were nearly dry. The wet cultivation under rivers, in operation at the time of my visit, was therefore confined to the land watered by the river Bhowany and its irrigation channels, some land watered by a channel of the Cauvery near Nerur, a few blocks of land in the neighbourhood of Darapuram watered by the Ambravutty, and the land in the neighbourhood of Pothanore and Coimbatore watered by the Noyel river.

26. It has been stated that the river irrigation supply in Coimbatore is, thoroughly utilized as far as this is possible but, the results of my observations lead me to form a different conclusion. Irrigation water is the one great want of the District and, I feel convinced that, no great difficulty would be experienced in increasing considerably the area of land under river irrigation. The drainage of nearly the whole District is towards the east into the Cauvery, which must, after heavy rains, receive immense volumes of water from the Coimbatore District, judging from the great width of the beds of the streams near their junction with the Cauvery, and the recent evidences they show of high floods.

Much of the Coimbatore water flows into the Cauvery.

27. It may be true that the drainage water from Coimbatore produces in Tanjore, as good results as it could have effected in the Coimbatore District but, while Tanjore would not suffer to any serious extent from losing the water, Coimbatore would benefit very largely from retaining it or, the greater portion of it.

28. The area, irrigated by river water, might be very considerably increased with the water now available for irrigation if, the cultivators could be induced or, compelled, to use the water in a less lavish and wasteful way than is now, universally, the practice, where the only trouble connected with the application of the irrigation water is, the raising of a sluice door.

A great deal more might be effected with the water now available.

29. The land under river irrigation is almost exclusively cropped with paddy; raggy is sometimes grown upon it but, this is only occasionally and, when there is any doubt as to their being sufficient water to mature a crop of paddy.

30. The largest quantity of paddy is produced in the Erode and Sattiamungalam Taluqs, under irrigation from the Bhowany river. The next largest producers of paddy are the Caroor, Darapuram and Oodumulpettah Taluqs, in these Taluqs the Ambravutty supplies the irrigation water. During the official year 1874-75 there were 72,000 acres under paddy. There is nothing worth special notice in the cultivation of the irrigated land, it differs in no respect from the practice in other parts of the Presidency.

31. The usual practice when irrigating paddy with water supplied by gravitation is, to apply daily a quantity sufficient to cover the ground to a depth of two inches, half of this, or, one inch in depth, the ryots say, is absorbed by the soil and, the other inch flows off upon the neighbouring land, the owner of which, takes from the distributing channel another inch, in order that his land may be covered to a depth of two inches; he, in his turn, passes off half of the water to his neighbour's land. In this way, the quantity of water actually consumed is, a depth of one inch, daily, over the area under crop, or, for raising and maturing an acre of five months' paddy, a volume of water, *one acre in area and twelve feet deep*, is required. Such a deluge of water would ruin any ordinary land situated on the level but, fortunately for the cultivators of the irrigated land the water is, in most instances, at a much higher altitude than the irrigated land, and this has admitted of the land being laid out in terraces, in this way, the possibility of the irrigation water accumulating on, or in, the land, to an extent to prove injurious is provided against.

Large volumes of water required to mature one acre of paddy.

32. I am convinced that on most of the irrigated land were the soil properly tilled and manured, there would be no difficulty whatever in producing as good crops of paddy as are now grown, with one-third or at the outside, one-half of the quantity of water now usually employed.

33. On terraced land when the soil is not properly tilled, not manured, or manured only with exceedingly small dressings, it undoubtedly pays the ryot to use the irrigation water *very* freely, *provided, it contains silt.* In such cases the water, to some extent, supplies the place of the manure. The terraced paddy land, is not likely to be brought into a swampy state whatever quantity of water is applied. The terraces, are so many filter-beds placed in the form of steps, the highest being, of course, nearest to the irrigation source.

Silt supplies manure to Paddy crop.

34. When the rivers are in flood their waters, I am informed, contain a very large quantity of suspended silty matter and, at the time of my tour, though there had been no rain for two months or more, the water of each of the rivers when placed in a vessel and left undisturbed for a few hours deposited a distinct layer of fine silt. The beds of the rivers, as far as I saw, afforded but little evidence that, much silt is brought down, but, this absence of silt deposits in the river beds may, I think, be due to the rapidity of the current, during the time of floods. A large amount of silt may be deposited on the land, by the irrigation water from these rivers, and yet there may be but little evidence in the river beds that silt is brought down. A rapid current may prevent the deposit of the suspended silt, until the water reaches the field and becomes stationary. An enormous amount of silt is undoubtedly brought down into the low country by the rivers that rise in the Neilgherries, and the other high ranges of hills; the cultivators of land on the slopes of the Neilgherries know to their cost, what a quantity of fine soil is, during heavy rains, washed down the slopes into the neighboring streams.

Irrigation water contains silt.

35. In one or two places where, at the time of my visit, the irrigation water used was almost clear, I found some luxuriant paddy crops, growing on land which had not received any manure for years, excepting, a few cart-loads, per acre, of the green plant of mudder and wild indigo. In these instances the crops may have been feeding on silt previously deposited, brought into activity by the irrigation water. It is of course possible for a water to be clear and yet for it to possess highly fertilizing properties, indeed, a water may contain in solution plant food of the utmost value. As before noticed the principal rivers in Coimbatore rise in the ranges of mountains which border the District and, as these mountains are formed chiefly of primary rocks in which potash-felspar is one of the principal constituents, it is probable that the rain water in passing over and through these rocks, may take up potash and carry it down into the streams below; and, in this way, the irrigation water may contain a considerable quantity of potash, a mineral, which enters largely into the food of all agricultural crops. Again, a clear water may contain a large quantity of carbonic acid gas and this, is the case, especially with the water of jungle streams which rise in and flow through land covered closely with rank growing vegetation. We know that, the Coimbatore rivers obtain their water chiefly from such jungle streams and, we may reasonably take it for granted that, their waters do contain a large percentage of carbonic acid gas. The great solvent properties of carbonic acid gas are well-known; when carried into the soil by the irrigation water, it acts upon and sets free large quantities of previously inert plant food, and in this way contributes to the production of a good crop. Of course, there is a wide difference between the action of an irrigation water containing potash and, that of one containing only carbonic acid; the former, supplies directly the material which aids in the production of the crop, the latter, merely stimulates into activity the plant food previously in the soil, hence a piece of land irrigated by the former water may be maintained in a fertile state for years, while land irrigated by the latter becomes gradually poorer and poorer as each successive crop is removed. But, a water may contain no appreciable quantity of either potash or carbonic acid, and yet, it may produce good effects when used in irrigation. Air is almost as necessary as water for the healthy growth of the roots of most plants: when irrigation water is properly applied that is, when it filters down through the soil, it carries with it a large quantity of atmospheric air, the oxygen of which, acts on the previously inert plant food and brings it into activity, in much the same way as carbonic acid.

Clear water may possess fertilizing properties.

Air necessary for the healthy growth of plants.

36. My own impression is, that the good effect produced by the irrigation waters of this District is primarily due to the silt deposited on the irrigated land, at certain seasons of the year; for, I made frequent inquiries when visiting this land regarding the yield of the crops it now produces, and, the yield of those it produced twenty or, thirty years ago, and, the invariable reply I received was, that the crops now produced yield quite as satisfactorily as those grown on the land twenty or thirty years ago. Now, if the good effect of the irrigation water was due only to the solvent action of carbonic acid, or oxygen, the water might contain, it is

clear that, the soil would have become less productive year by year as the plant food in the soil was used up by the successive crops.

37. I have said that in this District good crops of paddy might be raised by one-third, or at the most one-half of the quantity of water now usually employed provided, *the ryot manured and tilled his soil properly.* If, the irrigation effects are due chiefly to the action of silt, it is clear that, the less water the ryot uses the less silt will his land get; from the ryots' point of view then, with such water, it is desirable to employ as much as can be obtained; but, the question assumes altogether a different aspect when viewed from the stand-point of the State, which, supplies the water, and which, has 90 per cent. of its land altogether without water. In this country where irrigation water is so invaluable, and where in some seasons, from its absence, so much land is unproductive, it is I think, a serious mistake to allow irrigation water to be used so lavishly merely that, *the ryot may thereby be saved the trouble and expense of properly tilling and manuring his irrigated land.* If, the State, in order to provide manure for the land of the ryot is, obliged to supply twice as much water as is absolutely necessary, it is clear that it is providing the manural matters at a most excessive cost.

A serious mistake to allow irrigation water to be used lavishly.

38. To produce an acre of paddy, as I have already shown, a volume of water is required of one acre in extent and, twelve feet deep or about 3,267,000 gallons; estimating that each gallon contains ten grains of suspended silty matter, capable of being deposited on the irrigated land this would represent a dressing of silt, at the rate of about two tons or about six cart-loads per acre, a very liberal manuring for a crop of paddy.

39. The water of the Calingaroyen Channel after a drought of several months' duration was found, by Mr. Charles Benson, M.R.A.C., to contain three grains of silt per gallon. He examined two samples of the water, one from near the head of the channel and the other from the portion of the channel near Erode; the former contained only three grains of silt per gallon while, the latter which was taken at a place about ten miles lower down the channel contained five grains per gallon. This extraordinary result, was afterwards explained, by the fact that the sample, from near the head of the channel was taken one day earlier than the other sample, and that there was in the interval, a fall of rain amounting to ·27 inches. If, such a slight fall of rain as ·27 inches will add two grains of silt per gallon to the water, it will readily be understood that during the monsoon rains, when the paddy crops are being irrigated, a very large quantity of silt must be in suspension in the irrigation water.

40. Of course, if only half the usual quantity of water was used, there would, be a loss in the year, for each acre cropped with paddy of one ton of silt which, would have to be made good from other sources if, the ryot would keep up the fertility of his soil.

41. The ryots who hold river irrigated land are generally in much superior circumstances to those who rent dry land only; their dwellings are much more

substantial and roomy and the people seem to be in comfortable circumstances. I was sorry however to observe that these ryots, who might be expected to be better farmers than their poorer brethren, practised a system of husbandry in no way superior to that followed by the poorest ryot in the district. The very circumstances which have tended to raise these men a little higher in the social scale, than the poorer cultivators of dry land, have tended to produce results antagonistic to improved farming; for in most instances they, instead of cultivating the land themselves, sub-let it under an agreement for one or more years to under-tenants who, rarely possess any capital excepting sometimes what is represented by two or three pairs of wretched undersized plough cattle. In different parts of the District, there is a difference in the terms stipulated for tenancy; in some places the sub-tenant finds the working cattle, does the whole of the labor from seed-sowing until thrashing, supplies the seed, and such manure as is used and, in return, he receives of the produce from one-tenth to one-third of the grain, according to the productiveness of the land, and one-half of the straw; the ryot, of course, pays the Government rent out of his share; when, the ryot finds the plough cattle he takes the whole of the straw and, when he finds the seed, he takes half of the straw. Very frequently the sub-tenant stipulates to give a fixed quantity of clean paddy, for each acre of ground he rents from the ryot. As, in most of these instances the sub-tenant's interest in the land ceases after the removal of the crop, it is not likely that he will do anything by adopting superior culture or, by using manure, to improve the condition of the land.

Wet land farming in no respect better than dry land farming.

Wet land sublet to pauper cultivators.

42. The position of most of these sub-tenants is extremely bad; in a good season they but just manage to comply with the conditions under which they hold the land but, in most seasons they are unable, from the produce of the land, to pay to the ryot, the stipulated quantity of grain, and to repay him along with the interest, the advances of grain received for their daily support during the growth of the crop. The consequence is that, most of these sub-tenants are deeply involved in debt to the ryot, and are practically his serfs. The ryot, in dealing with his sub-tenants, exacts fully the terms agreed upon; if, the crop does not return as much grain as the sub-tenant promised to pay, the ryot takes the whole crop, and the balance remaining stands to the debit of the sub-tenant at a fixed rate of interest, in grain.

Sub-tenant on wet land in bad circumstances.

43. As before noticed, good crops are produced on much of this river-irrigated land but, this is due entirely to the peculiarly favorable conditions met with on such land. I saw land which was said to produce annually in an average season in two crops from 1,200 to 1,300 Madras measures of paddy, without the aid of any manure excepting three or four cart-loads of the green plant of mudder or wild indigo. But, the water expended on an acre of land in producing such crops would, under good management, have sufficed for the requirements of four or five acres of wheat or maize, one acre of which would have yielded as much human food as the acre of paddy.

The water expended on one acre of paddy would suffice for four or five acres of wheat or maize.

44. The right-of-occupation of much of this river-watered land now commands a high price, sometimes as much as from 200 to 250 rupees per acre; while, that of much of the adjoining dry land would not fetch more than 8 or 10 Rupees per acre. I was shown some irrigated land for which twenty years ago the right-of-occupation was considered to be worth only 50 rupees per acre, but which now is valued at 200 rupees per acre; this great increase in value was not due to any improvements having been effected by the lessee or puttah-holder during these twenty years but, to the largely increased money returns now realized from such land. When the ryot has, at much personal labor, or expense, converted dry land into irrigatable land, by altering its surface and laying it out in terraces, he has, of course, a perfect right, when transferring his holding to an incoming tenant, to demand the full value of the improvements effected; but, when the increased value is due to causes over which he has no control, the State should, I think, share in the larger returns. In most instances, the present high value of the right-of-occupation of this land is not due to any improvements effected by the occupying tenant or, by any of his predecessors but, to the great increase in the population, and, the consequent increased local value of agricultural produce. When the right-of-occupation of irrigated land, situated in ordinary agricultural localities, commands rates out of all proportion to what would represent a fair return on the capital originally sunk, in converting the land into irrigatable land, it is clear that the rent paid by such land must be *very moderate:* In many places the annual Government rent for such land is about 9 rupees, per acre, for one crop, and 12, or, 13 rupees per acre, for two crops; if such land will yield in two crops say, 1,000 Madras measures worth 50 rupees, the net return to the ryot is a very handsome one.

High price at which right of occupation of river irrigated land sells.

THE FARMING OF THE LAND IRRIGATED FROM WELLS.

45. In 1871-72 there were in the Coimbatore District 57,437 wells, of which 49,222 were in good repair and, in full use: assuming that there are, now in the District, 50,000 wells each capable of watering 3 acres of land, there will be altogether 150,000 acres irrigated from wells.

46. The wells are met with chiefly in the neighbourhood of the large towns and villages. From the presence of these wells, the outskirts of many of the towns present a very different appearance to what is seen further out in the District.

47. From conversations with Ryots regarding well-sinking, I learnt that, many of them would attempt to sink wells if, there was any certainty of meeting with water at a moderate depth, without the necessity of cutting through hard rock. I was shown several places where Ryots had gone to much expense in attempting to sink wells and had failed. Well-sinking as conducted by the Ryot is attended with great uncertainty and as, the wells cost frequently from 150 to 300 Rupees, it will readily be understood that after half completing a well and expending a sum equal to, say, one-half of its estimated cost, it is a very serious matter to a Ryot, to have to abandon the work.

Many more wells would be sunk if well-sinking was attended with less uncertainty.

48. Of course, the greatest uncertainty attends the sinking of the first well in a locality, and, there are but few cultivators willing to encounter the risk.

Government should lead in well-sinking where there are yet no wells.

49. In tracts of country suited for wells, but which are yet without them, Government might, I think, set the example in well-sinking; if successful, the probability is that the Ryots would follow the example and sink other wells in the locality, and in this way the general revenue of the District would be made more certain. To meet the interest on the capital outlayed in sinking these wells, a water rate might be charged on the land watered from them.

Land Improvement Act.

50. I was surprised to find so little known regarding the Land Improvement Act, under which, Ryots could so readily obtain money, on reasonable terms, for use in sinking wells. I informed many of the Ryots the terms under which they could, under this Act, obtain money for well sinking, and they generally expressed their readiness to sink wells if, provided with money in accordance with the terms of the Act. Some, considered that there should be a provision in the Act, under which the outlay should not be chargeable against the Ryot when the further sinking of a well had to be abandoned, from hard rock being met with or, from the water-bearing strata being found to be too far down. They said that it would be a great hardship if, a man borrowed, say 200 Rupees from Government and after expending half of the amount, in an unsuccessful attempt in well-sinking that, he should be called upon to make good the loss. I explained to them that if, in the place where it was proposed to sink a well, a well-auger was first used, to test the depth of the water-bearing strata and, the nature of the rock overlying it, there would be but little risk in sinking the well but, they still contended that, Government should bear the loss when, the sinking of a well had to be abandoned.

The employment of a well-auger would remove many of the uncertainties attending well-sinking.

51. Of course, there will always be some amount of risk attending the sinking of a well, but if, the Ryot makes the attempt, in the place pointed out to him by an Officer of Government, appointed for the purpose, and, it becomes necessary for any reason to abandon the work before completion, I think that, the Ryot should not bear the loss. It would only be in rare instances, if proper precautions were taken, that, it would be necessary to abandon the work when only partially completed, and, such losses might be recovered by the State, by slightly increasing the interest chargeable on money advanced for well-sinking.

52. There is I think but little probability of there being a large increase in the number of wells in this District as long as the sinking of a well is attended with a risk such as will frequently represent the loss of a sum, equal to a whole year's income of a Ryot; and, a half, or, even, 1 Per Cent. added to the rate of interest chargeable for money advanced by the State, under the Land Improvement Act would be no hinderance whatever, to those desirous of sinking wells.

53. Of course, in parts of the country where there are already many wells, great caution would have to be exercised in increasing their number or, injury may be done to those already existing from their water supply being lessened.

54. There are considerable tracts of country yet without wells, in all parts of the District, in which wells might be sunk, and where subterranean water is as likely to be met with quite as near to the surface, and in as large quantities as in other parts of the country where there are wells.

Superstitious custom in selecting site for a well.

55. Superstition guides the Coimbatore Cultivator in the choice of a site for a well; generally, he procures a sheep and, drives it to the land in which he desires to sink a well; he then pours some water over the head of the animal and sets it at liberty, it wanders over the ground and, the spot of land over which it shakes its head, to get rid of the moisture, is the place in which the well must be sunk. I could never get from any Ryot any satisfactory explanation of the reason they had in following this ridiculous practice; they admitted when pressed, that the result of sinking wells in sites so selected, was often highly unsatisfactory. The prevalence of this superstitious custom shows what uncertainties attend well-sinking in this District for, the men who follow this practice frequently possess a good deal of common sense in regard to matters which daily occupy their time and attention. They select their site for the well in much the same way as men in other countries decide a course of action on the result of the throw of a coin. However the Coimbatore custom is quite as sensible as the practice adopted in other countries when, the divining-rod is used in the search for water.

56. It is highly unsatisfactory, that an improvement such as the sinking of a well, should be attended with such uncertainties when, it is in the power of the State, at a very trifling expense, to do away with many of these uncertainties.

Trial borings to be made by Government.

57. The Ryots when told that it was possible to bore down through the ground by means of an auger to the water bearing strata, were much delighted, and, expressed their great desire that each Taluq should be provided with one or two of these augers. I, would strongly advise, that, a couple of augers should be obtained for use in the Coimbatore Taluq in the first instance, they should, I think, be placed in the charge of an intelligent Overseer of the Public Works Department, after a little practice, under different conditions he would be able to select the most suitable places for boring for water, which places might be marked by a stone and, the exact position noted on the village map, with information, showing the nature of the strata passed through and, the depth at which water was found. After such experimental tests had been made, the Ryots might sink the wells at any time, when most convenient, when labor and money are available.

Water-raising arrangement.

58. Throughout the District cattle-power is everywhere employed for raising water from wells. The water is lifted from the well in a skin bucket, to the bucket is attached a rope which, at its other end, is fixed to the yoke of a pair of cattle; a roller or pulley is fixed about 4 or 5 feet higher than the discharging trough and, slightly over the well, over this roller, or pulley, the rope travels as the bucket ascends or descends. The bullock path is a very steep incline. When raising the bucket the cattle walk down the

sloping path until the bucket reaches the full height and discharges its contents when, the cattle are again backed up the slope, and the bucket again sinks into the water, to be again raised by the forward motion of the cattle, and thus the process is again and again repeated. This arrangement is certainly very simple, however the cost of raising the water is very great. From experiments I made during my tour, and from the information I then gathered, I find that, when the water is to be raised about 20 feet, it costs the Ryot 2 Rupees for watering an acre of ground once, with an application of water equal to about 23,000 gallons, which is an average watering and equal to a rainfall of about one inch.

Cost of raising water by ordinary means is very great.

59. As, an ordinary crop of Cumboo, Cholum, or, Raggy, receives during growth on the average, from 10 to 12 waterings it will be seen that, the water costs the Ryot from Rupees 20 to Rupees 24 for each acre, of any one of these crops he produces on land irrigated from a well.

60. The following shows the cost of raising water from a well of average depth, by the water-raising arrangement just noticed;—

Depth of the water below the surface of the ground ...	20 feet.
Cost of the pair of cattle required	40 rupees.
Cost of earthwork, cistern, and, woodwork	20 „
Cost of skin-bucket and rope	6 „
Duration of skin-bucket and rope	3 months.
Buckets emptied per hour	65 No.
Contents of the bucket at the point of discharge ...	20 gallons.
Time occupied by the cattle in going down the slope	10 to 15 seconds.
Time occupied by the cattle in backing up the slope and making ready for return journey	45 seconds.
Day's work	6 hours.
Daily pay of driver	2 annas.
Daily pay of water-distributer	1½ „
Daily hire of cattle (when hired)	6 „

The cost, per day, will be as below;—

	RS.	A.	P.
Hire of cattle	0	6	0
Hire of driver	0	2	0
Hire of water-distributer	0	1	6
Interest and, wear and tear, at 10 per cent., per annum, on the capital invested, Rupees 66, charged over 250 working days in the year	0	0	5
Cost of replacing buckets and ropes, once in 3 months, charged over 250 working days in the year ...	0	1	2
Total ...	0	11	1

It takes on the average 3 days' full work to water 1 acre of land, the cost per acre is thus Rupees 2-1-3. When the Ryot employs his own cattle, which is the usual practice, and, drives them himself which is also usual, the actual outlay, of course, will be less but, the amount saved, will be but a poor return to the Ryot for

his labor and, the labor of his cattle; and, it must be remembered that, as the work is severe, the cattle do not last long and, require to be replaced at, sometimes very short intervals. The expenses cannot therefore be put at less than the sum I have mentioned. The working hours are generally from 7 A.M. to 10 A.M. and from 3 P. M. to 6 P.M. daily, that is, 6 hours in all. Assuming that, the work throughout the working hours is performed in a regular way, and that 65 buckets, each containing 20 gallons, are raised per hour, the total quantity raised during a day will be 7,800 gallons, at a cost of Annas 11 Pie 1 or, about 11,260 gallons for one Rupee. This may be accepted as the average cost incurred for raising water from wells; the wells, are in some places from 30 to 40 feet in depth, but in other places, they are only from 12 to 15 feet deep and, I think that, there are many more wells under 20 feet in depth than there are of a depth greater than 20 feet. There is in different parts of the District a considerable variation in the size of the buckets used; I measured some buckets that could contain only 10 gallons of water and, I measured others that would contain 25 gallons at the least.

Double Mhote.

61. I was glad to see in the Town of Coimbatore, 8 Improved Water-lifts at work, all of the kind known as the "Double Mhote"; they were made from a model supplied by the Sydapet Experimental Farm. I learn that there is every prospect that this Improved Water-lift will be adopted in this District. The experience gained with the lift by the Coimbatore Municipality, has been of the most satisfactory character, the lift raises, when worked by one bullock, as much water as was formerly raised by two of the ordinary Water-lifts, each worked by a pair of bullocks.

62. The following shows the capabilities of one of these Improved Water-lifts; the working data was obtained from the experiments made at Sydapet; but the calculations are based on the rate of wages, cost of materials, working hours, &c., prevalent in the Coimbatore District;—

Depth of the water below the surface of the ground ...	20 feet.
Cost of the bullock rquired	53 rupees.
Cost of timber, bricks, lime and labor	100 „
Cost of the 2 skin buckets and the ropes	15 „
Duration of skin buckets and ropes	3 months.
Buckets emptied per hour	90 No.
Contents of each bucket at the point of discharge ...	30 gallons.
Day's work	6 hours.
Daily pay of driver	2 annas.
Daily pay of water-distributer	1½ „
Daily hire of bullock (when hired)	4 „

The cost per day will be as below;—

	Rs	A.	P.
Hire of bullock	0	4	0
Hire of driver	0	2	0
Hire of water-distributer	0	1	6
Interest and, wear and tear, at 10 per cent., per annum on the capital invested rupees 150, charged over 250 working days in the year	0	1	0

	Rs.	A.	P.
Cost of replacing the buckets and ropes, 3 times a year, say rupees 60, charged over 250 working days in the year	0	2	10
Oil, &c.	0	0	6
Total ...	0	11	10

The cost per day for working this machine is therefore Annas 11 Pies 10. When working at the ordinary speed 90 buckets are raised per hour, and, as each bucket contains 30 gallons when at the point of delivery, the quantity of water raised per hour is 2,700 gallons or, in a day of 6 working hours, the quantity raised is 16,200 gallons. For an expenditure of one rupee, 21,904 gallons of water can be raised to the height of 20 feet by the Improved Lift against, 11,260 gallons, raised for one rupee, by the old-fashioned Lift.

Great saving in cost of raising water by using the Improved Lift.

63. To irrigate an acre of land with the quantity of water generally used, the cost will be, by means of the old-fashioned Water-lift, Rupees 2-1-3 or, by the Improved Water-lift Rupees 1-1-1.

64. I have mentioned before that a crop of Raggy, Cumboo, or Cholum, when grown with the aid of well water, receives from 10 to 12 waterings; the cost then, of the irrigation water for an area of one of these crops will be, when the unimproved Lift is used, Rupees 22-13-9 or, when the Improved Lift is used, Rupees 11-11-11; thus, showing a saving of about 11 Rupees per acre; and, the saving will be greater in the case of many other of the crops raised with water from wells, from the greater quantity of water required.

65. We have, in this District, as before noticed, 150,000 acres of land irrigated from wells, by means of these unimproved Lifts, if then, it is possible to save 11 Rupees, on each acre of crop raised, by substituting the Improved Lift for that now in use, a total saving might be effected amounting to, at the least, two million of Rupees, per annum, for it must be remembered that, much of the land bears 2 crops in the year.

Enormous saving if Improved Lift generally adopted.

66. We often hear of the poverty of the ryot, and yet, we find that, in the District of Coimbatore alone, on the small area irrigated from wells, a saving in the annual expenses of the ryot could be effected, that in the aggregate, *would be nearly equal in amount to the entire annual rent of the District payable to the State.*

67. Water, manure, more cattle labor, and, more manual labor are imperatively demanded by 90 per cent. of the cultivated area. By adopting the new Water-lift, the ryot will be able to water double the area he was previously able to irrigate; if, he prefers not to extend the irrigated area of his holding, he will have cattle labor, and manual labor set free for collecting and bringing manure to his land, and for the more thorough tillage of his soil, &c., &c.

By adopting the Improved Water-lift, labor, &c., rendered available for other improvement.

68. Not only is it possible to reduce greatly the cost of lifting water from wells, but, the water after being raised, might be made to go a great deal further

than it now does, if, proper means were taken. As, a general rule the soils of the Ryot contain but a very small percentage of organic matter, and, the tendency of his farming is to reduce this small percentage still lower. The action of organic matter (humus) in the soil is well known, it enables the soil to take up moisture from the air and to store up that moisture ready for the use of plants. An application of a quantity of water equal to half an inch of rainfall on a soil containing 5 or 6 per cent of organic matter, will produce better and more continued effects than a quantity of water equal to 1 inch of rainfall will on a soil containing only 2 or 3 per cent of organic matter, other conditions being equal. In other words, if the soil was properly manured and tilled, the quantity of water that now suffices only for 3 acres, would suffice for 6 acres, and the effective work of a well would be doubled. There would be no practical difficulty whatever, in increasing largely the organic matter in the soils; it would only be necessary that the Ryot should use farmyard manure in manuring his soil, instead of burning the dung of his cattle or, that he should plough into the soil one or two green crops. The general use of cattle dung as fuel, is the curse of Indian Agriculture, not only is the soil deprived of so much direct plant food but, the physical conditions of the soil are seriously deteriorated when it is cropped without the aid of organic manure. Mr. Schiffmayer, in his experiments, elsewhere reported, found that, the soils of the Sydapet Experimental Farm had their powers of absorbing and retaining moisture increased 10 per cent. by the addition of 5 per cent. of organic matter.

69. Much more skill is exhibited by the Ryot, in the cultivation of the land irrigated from wells, than in the cultivation of either river irrigated land or, ordinary unirrigated land.

70. The cropping of the land irrigated from wells is very varied. Cholum, cumboo, and raggy occupy the largest area, in some portions of the District, land irrigated from wells is cropped only with these crops; as before noticed the ryot recognizes garden varieties of each of these cereals and, as he always sows these varieties on his land that is irrigated from wells, the crops have acquired a habit of early maturity.

71. As a general rule, the crops standing, at the time of my tour, on land irrigated from wells were good as regards, length of straw and uniformity of growth but, the heads or, ears, were generally very small and badly filled with grain.

Tobacco largely grown.

72. Tobacco, is largely grown in this District and, it is raised almost exclusively on the land dependant on irrigation from wells. The area annually cropped with tobacco is about 20,000 acres. The crop, is grown throughout the District. The climate of Coimbatore is, generally, well suited for the production of Tobacco but, it is ill suited for the curing operations. Hence, tobacco grown there, should either be sent to a more genial climate to undergo the curing processes or, it should be cured in factories erected for the purpose in which, the peculiar atmospherical conditions required, may be secured.

73. The late Government Quinologist, J. Broughton, Esq., examined, chemically, a number of samples of tobacco, which had been produced in different parts of this District. The following are some of the results obtained;—

Where grown.	Per cent. of ash.	Per cent. of Carbonate of Potash in ash.	Per cent. of Nicotine.
Coimbatore.	22·856	2·94	3·32
Do.	22·606	5·64	4·95
Do.	19·923	7·92	4·90
Pollachy	24·987	4·39	1·95
Moocasipoodoor	25·73	7·67	2·24
Coorchy	26·39	7·93	1·17
Poondoray Semoor	23·34	2·65	1·29
Aval	23·49	19·97	1·46
Monigumpollium	26·65	2·61	2·95
Madhally	23·45	5·33	2·32
Sattiamungalum (*A*)	17·09	14·74	2·88
Do. (*B*)	21·34	8·87	3·74
Do. (*C*)	25·14	9·14	3·02

It will be observed that the percentage of carbonate of potash, found in the ash of the tobaccos, varied very considerably; and, it is, it must be remembered, upon the presence of this salt, in the Tobacco, in a sufficient quantity that, its proper burning so greatly depends. Mr. Broughton also examined a sample of Havana and of Manila tobacco which, had been produced in the District, the result was as follows;—

Variety.	Per cent. of ash.	Per cent. of Carbonate of Potash in ash.
Havana	22·55	6·18
Manila	23·25	10·25

The tobaccos contained only a very small percentage of nicotine and their flavours were considered by Mr. Broughton to be very good. With reference to these tobaccos, he wrote in his report;—" I consider that these samples show that foreign tobaccos, if grown in suitable localities in South India, can be produced of their foreign quality. The Manila tobacco, if it had been cured with care by a European or instructed Native would, I am convinced, have possessed the high qualities of foreign Manila tobacco." These samples were produced in the Erode Taluq on an ordinary red soil. The best tobaccos are said to be produced in the Taluqs of Coimbatore, Erode and Sattiamungalum. I saw tobacco growing in all the Taluqs I visited and, observed good crops, and indifferent crops growing in all. However, the market value of the tobacco produced in the southern Taluqs, is never so high as that of the tobaccos of the northern Taluqs. If, ever the production and manufacture of tobacco becomes a Government monopoly in this Presidency, the District of Coimbatore would offer great facilities for the production of tobacco on a large scale. There are good tobacco soils in all the Taluqs but, the Taluq of Sattiamungalum would, I think, afford the best soils and the most favourable climate for the curing operations.

Coimbatore offers great facilities for producing tobacco on an extensive scale.

74. It is said that the red soils produce the best qualities of tobacco and, I should certainly prefer these soils as, they are generally more friable and porous and, do not bake and contract during a slight drought to the same extent as do the black soils. The season in which tobacco is sown varies in different parts of the District but, generally, August and September is the sowing season. The seed is usually sown in nursery beds and, the young seedlings are transplanted out into the field when from 6 weeks to 2 months old. There is nothing worth special notice in the tobacco cultivation of this District. Ryots always endeavour to put their tobacco land in a good manural condition, they fully recognize the exhausting nature of the crop and, the demand it makes upon the soil. Tobacco land is usually manured, by folding sheep upon it, and occasionally, by dressings with village ashes. Tobacco land usually bears a crop of raggy in addition to the tobacco during the year. The harvest season for tobacco, varies of course with the sowing seasons but, over the District generally, the tobacco harvest is in the months of February, March and April.

Great want of uniformity in crops.

75. There is perhaps no crop grown by the Ryot which indicates more accurately the condition of the soil and, the character of the cultivation, than does a tobacco crop. It was not unusual in going through the District to observe, almost side by side, crops that would, probably, not yield 400 lbs. of tobacco, per acre, and others, that might fairly be expected to yield from 750 to 1,000 lbs., per acre, on soils apparently of the same class.

76. The Tobacco crop, from the cost of the waterings it receives, is an expensive one; however, the returns are good, under satisfactory conditions. A crop of 750 lbs., which may be taken as an average one, on fairly farmed land, will realize from 60 to 65 rupees, that is, after the leaf has been prepared for the market; and, this, after paying the Ryot for the labor of himself and his cattle and, for such occasional labor as he may employ, helps towards the payment of the rent of the holding.

Cured tobacco always bad.

77. I saw some very well-grown tobacco in different parts of the District but, everywhere, the cured tobacco was inferior. The advantages the District possesses for the production of the tobacco plant, are nearly altogether lost, from the treatment the leaf receives after leaving the field. The curing process is almost exactly the same as that followed all over the Presidency. There is I think, no probability that, a good marketable tobacco will be produced in this District as long as the curing is in the hands of the Ryot. It is quite impossible that the Ryot, with the very limited means at his disposal, can produce a sample of tobacco that can, at all, approach in appearance or condition, the tobacco produced by the skilled agency and elaborate appliances, employed in other countries.

Tobacco curing factories wanted.

78. In many parts of Coimbatore, the curing of the tobacco produced, would give ample employment to a factory and, several of these might I think, be started with advantage. It is obvious that, if the curing operations of the factory, began with the green leaf when newly harvested that, the area of country from which the tobacco could be received, would be much more limited, than if, the factory began operations on half cured tobacco. The green leaf

would not bear distant carriage, it is so liable to heat when full of sap ; on the other hand, the quality of a tobacco depends very largely upon the skill with which it has been treated in the early processes of curing.

79. Nearly all the tobacco, raised in this District, is cured under the verandahs of the Ryots' dwellings, or, inside their dwellings. Sheds are never erected purposely in which to cure tobacco. The first stages of the curing are performed chiefly out-of-doors, the leaves being suspended in various ways while, drying. I saw in some places, rows of castor oil plants, supporting lines over which tobacco leaves were suspended.

80. Much of the tobacco produced is sent to Malabar. It is said that, a quantity of the Coimbatore tobacco is also forwarded to Trichinopoly where, it is used up with the tobacco produced there. Coimbatore tobacco sells for, when cured, from 5 Rupees to 12 Rupees per 100 lbs.

81. There can be no doubt but that, tobacco culture could be largely extended in this District; the climate is favourable for the growth of the crop, there are large areas of land suited for the growth of tobacco and, the special food of the tobacco, potash, is available in large quantities in the shape of saltpetre which is produced to a very considerable extent in many places. One serious defect, universal in the tobaccos of Southern India, arises from the deficiency of potash in the soils on which they are grown; this deficiency, could be remedied to a certain extent, by using saltpetre as a manure, this, on decomposition, would afford nitric acid and potash, foods which are so largely consumed by the tobacco plant, when growing under favourable conditions.

Tobacco cultivation might be largely extended.

82. Chillies occupy about 15,000 acres of land in the year. They are grown principally in the Pollachy, and Erode Taluqs. The produce is consumed chiefly within the District. The crops that I saw were generally good. The return from one acre of land under chillies is very much less than the return from one acre under tobacco but, on the other hand, the expenses attending the raising of a crop of chillies, are much smaller both in the field and, in preparation for the market.

Chillies.

83. Sugarcane occupies about 3,000 acres of the area annually under crop and, fully one-third of the area is in the Coimbatore Taluq. The crops of sugarcane that I observed were very good and apparently well cultivated. The cane is usually milled where it is grown and, the juice made into jaggery. The process is rude, and, wasteful. I was shown some crops from which, a yield of about 100 maunds of jaggery, per acre, was expected, worth about one rupee, per maund. Land intended for sugarcane is always well manured if the Ryot can get this without much trouble. Certain land, is regularly cropped every second year with sugarcane; such land is said to have diminished in yield, during the last 30 years, from 120 maunds down to 80 maunds, of jaggery, per acre.

Sugarcane.

Sugarcane land diminished in produce.

84. Sugarcane is an expensive crop to grow, where the water has to be raised to a considerable height as, it is usually watered every third day and, is on the

ground for about a year; still, the Ryot who grows it, is afforded regular employment for himself, and for his cattle, for which services, he obtains reasonable compensation in the returns realized when the crop is sold.

85. Seeing that, the District offers so many facilities in its climate and soils for the production of sugar, it is to be regretted that such a small area is cropped with the sugarcane. Under a good system of farming, there would be no great difficulty in increasing the area very largely. But, before the Ryot can enter more largely upon the cultivation of sugarcane, he must adopt a more rational system of agriculture. Sugarcane cannot be produced under the " starvation system " which characterizes the Ryots' treatment of land; manure and thorough tillage are required in order to secure fair results.

The produce of sugarcane demands good farming or good fertile soil.

86. The fact that while this District offers many facilities for the production of sugarcane, it produces in the year, only 3,000 acres on its 2,200,000 acres of occupied land, shows, how low is the agricultural practice. In the sugarcane, the Ryot possesses a crop which will, under fair average conditions, bring in a gross return of 80 to 100 rupees, per acre, and yet, he occupies 95 per cent. of his cultivatable land with crops that do not bring in a gross return of 12 rupees, per acre.

87. The area, annually, under wheat is only about 2,500 acres and, nearly the whole is produced in the Coimbatore Taluq. The variety cultivated is *Triticum Spelta*. It is a bearded wheat and, its grain is covered by an adhering husk. The crop is sown during November and December, and is reaped in February and March. Wheat is always irrigated from wells, generally, about four times a month.

Wheat.

88. Coimbatore wheat is highly appreciated for its bread-producing capabilities. The large European population on the Neilgherries is supported almost entirely on wheat obtained from the Coimbatore District. The grain is admirably suited for making rolong with which the bread used by Europeans in this country, is chiefly made. The grain is hard and gritty and, does not make a good flour, hence the common practice of making rolong from it.

Coimbatore wheat in good demand.

89. The wheat plant is very short, and, the ear is small. The yield, of an average crop, is said to be about 400 lbs. per acre; that is, of grain-in-the-husk.

90. There would be no difficulty whatever in increasing largely the production of wheat in this District provided a better agricultural practice prevailed.

Wheat production might be largely increased.

91. There is a considerable demand, in Southern India, for wheat, at remunerative prices and, there are abundant facilities in the Coimbatore District for producing wheat on a large scale. All that is required is a better system of agriculture, in which, the soil will not be starved but maintained in a good fertile state.

92. There is some need for the introduction of fresh seed and, there would, I think, be no difficulty in obtaining from Egypt or, from Southern Europe, a variety suited to the Coimbatore climate.

93. Plantains, saffron, sweet potatoes, coriander seed, onions, &c., occupy the remainder of the land irrigated from wells, but the area under each of these crops is small.

Plantains, saffron, sweet potatoes, coriander, &c.

94. As before noticed, the farming of the land irrigated from wells, is superior to the farming of the District generally. Irrigation water is more carefully used by the Ryot when he has had to raise it to a considerable height, he then appreciates more fully its value, and accordingly uses it with care. During my whole tour I do not remember ever having seen any land that was swamped by well water, in the way that is so common when the water used, is supplied from a tank or a channel by gravitation.

The ryot when he has to raise the water from wells appreciates its value and uses it more carefully.

95. If, the users of irrigation water, supplied by gravitation, could be induced or compelled, to use it with the same economy that is practised in dealing with the water raised from a well, the state of the country would be very different to what it now is.

Ryots should be compelled to use river irrigation water as carefully as they use well water.

96. If a wheat crop, can be raised in the District with a quantity of water equal to about a rainfall of 16 inches, there is surely something very wrong when the Ryot is permitted to use in raising a crop of paddy, a quantity of water equal to a rainfall of 144 inches. There can be no doubt but that, an acre of land will, under wheat, produce as much human nutriment as an acre of land under rice.

97. The water of some wells contains mineral food in solution and, when such water is used, its influence is greater than that of pure water; however, I do not think that, the fertility produced on the land irrigated from wells, is due to any extent to the soluble plant food contained in the water; for, the Ryots generally agreed in stating that, their "garden land" which is the land watered from wells, is not productive unless manured. The active growth of crops on land irrigated from wells is due, I think, to the plant food being prepared and maintained in a form easy of assimilation by the growing plant, and, to the energies of the plant being stimulated by the favorable physical conditions under which it is growing; the carbonic acid, and oxygen brought in the irrigation water, playing an important part in the conversion to an assimilable form, of the raw plant food in the manure applied and, in rendering active, the previously dormant food in the soil itself.

Well water acts on the food in the soil and rarely supplies food.

98. Almost the whole of the manure the Ryot ever uses is expended on the land irrigated from wells. It consists chiefly of village ashes, and weathered sun-dried cattle dung but, the general practice in manuring this description of land, is to fold sheep on it during night, the animals being allowed during the day to graze elsewhere. The efficacy of the practice depending upon the quantity of excreta, solid and liquid, deposited on the land by the sheep during the night. The practice of sheep-folding is a good one but, in the hands of the Ryot it is not sufficiently developed. It is clear that, there can be no increase in the manural constituents of an arable soil, from the deposit on it of the solid, and liquid excreta of sheep, that depended for food entirely on the wild

Sheep-folding for manural purposes.

scanty vegetation produced on the soil during the dry season. Yet, the efficacy of sheep-folding as a means of fertilizing a soil, is universally admitted. However, in all civilized countries, when sheep are folded on land, they are provided on the land itself, with green crops, produced by the aid of manure, and, the sheep receive, in addition, a daily allowance of oil-cake, pulse, or grain, hence the higher fertilizing value of their excrement. As sheep-folding is conducted on land in this District there is but a slight increase in manural matters; the chief good, resulting from the plant food being left in a form easily of assimilation by growing crops.

99. Sometimes, land irrigated from wells is sub-let but, this is far from being the usual practice. When sub-let, the sub-tenant pays the Ryot or Puttah-holder one-fourth to one-third of the grain the land produces, the cultivating tenant retaining the remainder of the grain and the whole of the straw. Under such an arrangement, the cultivating tenant provides at his own expense the cattle, seeds, manure, labor, water-buckets, &c., &c.; the Government rent is paid by the Ryot who, holds the puttah or lease. When the Ryot finds the cattle, he usually gets one-half of the grain and one-half of the straw.

100. I have referred very briefly to the manuring of the land irrigated from wells as, I intend, when referring to the cultivation of the unirrigated land, to discuss the subject of manures more fully.

THE FARMING OF THE UNIRRIGATED LAND.

Large area of land altogether without water.

101. Of the total area of occupied land in this District, upwards of two million acres is altogether unaided by irrigation water.

102. The following statement shows the rain-fall registered in the different Taluqs, during the past four years;—

Official year.	Coimbatore.	Sattiamungalum.	Collegal.	Pollachy.	Erode.	Bhowany.	Pulludum.	Darapuram.	Caroor.	Oodumulpettah.
	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES
1871-72	24·53	28·55	35·01	42·33	22·40	20·82	20·72	18·94	24·99	28·14
1872-73	25·47	28·45	37·69	29·44	20·53	37·40	18·05	20·50	39·97	20·27
1873-74	22·13	21·37	35·82	27·66	21·81	17·33	17·11	15·37	26·60	24·78
1874-75	19·61	25·87	38·48	32·58	26·90	32·03	12·35	13·32	20·40	20·71
Average..	22·93	26·06	36·75	33·02	22·91	26·89	17·06	17·03	27·99	23·47

103. In Collegal and Pollachy the rainfall is fair. As a general rule, over the whole District, the heaviest rainfall is in May, October and November; and, the lightest in December, January, February and March.

104. Dry crops are extremely precarious and, unfortunately it is upon the dry crops chiefly, that the people must depend for food. On the better kinds of soils, fair results are obtained in average seasons: however the area of such soils is but small, compared with the area under occupation.

105. Since 1857, the area of the unirrigated land has been increased 45 per cent. In the official year 1857-58, the area under occupation, was 1,591,976 acres, of which about 85,000 acres was irrigated land, leaving 1,506,976 acres of land unaided by irrigation. In the official year 1874-75, the total area under occupation was 2,298,726 acres; from this, must be deducted the 85,000 acres of irrigated land, which leaves 2,213,726 acres of unirrigated land; or, there were, in 1874-75, 706,750 acres more of unirrigated land than in 1857-58.

Great increase in the area of unirrigated land.

106. I have before mentioned that after deducting the land permanently settled, the land under Government forests, hill tracts, and "waste," altogether 830,720 acres, there remains attached to Government villages, under the Ryotwary tenure 3,925,760 acres; of this 1,725,760 acres is unoccupied and pays no rent.

Large area of Ryotwary land not paying rent.

107. The large increase in the area of rent-paying land would, of course, be a satisfactory proof of progress, were the land properly farmed; for, there can be no doubt but that, under fair cultivation, the inferior soils, in the dry climate of Coimbatore, would yield much more produce, when tilled, than, if left to produce natural herbage for pasturage.

108. In this District, as well as throughout Southern India, the unrented land has contributed, and does contribute, largely to the maintenance of the rent-paying land.

The unrented land contributes largely to the support of the rented land.

109. The revenue from land has been maintained, by gradually bringing more and more of the unrented land under rent. Though, the gross land revenue of the District has been increasing, the average rent of the unirrigated land has, during the last 20 years, been gradually diminishing, as will be seen from the following statement :—

Land revenue maintained by bringing more land under cultivation.

Official year.	Total area.	Deduct area irrigated.	Net unirrigated area.	Gross rent.	Deduct rent of irrigated land.	Rent of unirrigated land.	Rent of unirrigated land per acre.
	ACRES.	ACRES.	ACRES.	RS.	RS.	RS.	RS. A. P.
1857-58 ..	1,591,976	85,000	1,506,976	25,31,004	5,50,000	19,81,004	1 5 0
1858-59 ..	1,626,115	85,000	1,541,115	25,88,441	5,50,000	20,38,441	1 5 2
1859-60 ..	1,708,426	85,000	1,623,426	26,72,323	5,50,000	21,22,323	1 4 11
1860-61 ..	1,727,980	85,000	1,642,980	26,92,342	5,50,000	21,42,342	1 4 10
1861-62 ..	1,776,971	85,000	1,691,971	27,33,874	5,50,000	21,83,874	1 4 8
1862-63 ..	1,829,542	85,000	1,744,542	27,92,762	5,50,000	22,42,762	1 4 7
1863-64 ..	1,910,024	85,000	1,825,024	26,49,901	5,50,000	20,99,901	1 2 5
1864-65 ..	1,959,536	85,000	1,874,536	24,11,925	5,50,000	18,61,925	0 15 11
1865-66 ..	2,092,501	85,000	2,007,501	25,11,080	5,50,000	19,61,080	0 15 8
1866-67 ..	2,199,089	85,000	2,114,089	25,95,782	5,50,000	20,45,782	0 15 6
1867-68 ..	2,214,111	85,000	2,129,111	26,08,243	5,50,000	20,58,243	0 15 6
1868 69 ..	2,229,311	85,000	2,144,311	26,24,533	5,50,000	20,74,533	0 15 6
1869-70 ..	2,245,729	85,000	2,160,729	26,37,372	5,50,000	20,87,372	0 15 5
1870-71 ..	2,307,358	85,000	2,222,358	26,49,784	5,50,000	20,99,784	0 15 1
1871-72 ..	2,293,926	85,000	2,208,926	26,28,772	5,50,000	20,78,772	0 15 1
1872-73 ..	2,290,482	85,000	2,205,482	26,15,898	5,50,000	20,65,898	0 15 0
1873-74 ..	2,285,509	85,000	2,200,509	26,13,114	5,50,000	20,63,114	0 15 0
1874-75 ..	2,298,726	85,000	2,213,726	26,24,119	5,50,000	20,74,119	0 15 0

110. Not having figures showing the actual area under irrigation in each year, during the period to which the statement refers, I have, in order to determine the area of unirrigated land, deducted in each year, 85,000 acres which is, about the average area annually under irrigation and, to determine the rent of the unirrigated land I have throughout the statement deducted 5½ lakhs of Rupees in each year, the average income from the 85,000 acres of irrigated land. The area under irrigation is, I believe, almost exactly what it was 20 years ago and, the revenue from it, has varied only slightly from the amount I have taken.

Decrease in the average rent of dry land.

111. It will be seen that the average rent of the unirrigated land, has fallen nearly 30 per cent. in the last 18 years. The decrease is not, I think, due to any reduction in the rent, but, to the large addition to the unirrigated area, of inferior land paying a low rent, which necessarily reduces the average rent of the whole.

112. Of course, the pressure of an increasing population, will gradually force under culture, more and more of the unrented land. We have seen that during only 18 years, this increase has amounted to 700,000 acres, and we may expect that this gradual appropriation of the unrented land will go on until, probably, the whole is taken up for cultivation. Now, it is certainly far better that such land should be under tillage in Districts circumstanced like this, *but, the absorption under tillage of the whole of the Ryotwary land, will destroy the resources upon which the Ryot has hitherto depended so greatly.*

Appropriation of the rent-paying land reduces the resources of the Ryot.

113. Under the inferior agriculture practised, the recent large increase in the area under tillage is, I think, a cause for serious alarm; for, whenever an unpropitious season occurs, the cultivators of this newly added area, which is, nearly always composed of inferior soils, have nothing whatever to rely upon, and they, as well as those connected with them, have to seek other means of support which, in some seasons, they cannot obtain except by Government establishing relief works. The 700,000 acres of land, added, during the past 20 years, to the area under cultivation, will probably be occupied by not less than 60,000 families.

Large increase in area of tilled land, of poor soils badly farmed, a cause for serious alarm.

114. As long as only the moderately good soils are tilled, a rude system of husbandry may suffice to meet the wants of the cultivators but, *directly the inferior soils are taken up for culture, it becomes necessary that an improved agricultural practice should be adopted.* The land, that has recently been added to the cultivatable area, is undoubtedly very inferior, and it is being cultivated in precisely the same rude way as the better soils, of which previously the cultivated area chiefly consisted.

A rude agricultural practice sufficient when good land abundant.

115. I saw large tracts of country which, the Ryots declared did not give more than about 5 bushels of grain, per acre, in the year; and, judging from what I saw of the growing crops, I should think that 5 bushels of grain would be as much as many of these soils would produce on an acre, under imperfect tillage and without manure; now, as 5 bushels of grain would not command more than

6 Rupees in the local market, it will be seen that, after deducting rent, cost of seed, and, cattle hire, or, cattle keep, the Ryot must get but a scanty subsistence, in return for the labor he expends on such land, but, this deplorable state of things is only what might be expected.

116. If, it is necessary that these inferior, previously rejected soils, must be cultivated, it is clear then that, a better system of husbandry must be adopted, in order to get out of these soils a fair return; and, I am convinced that, unless the agricultural practice in dealing with them is greatly improved, the State will experience greater and greater difficulties, on the recurrence of each unfavorable season, in supporting the people dependent on the produce of these soils.

Soils of the District.

117. Considerable portions of the District are covered by black soils, and some large areas by red soils, but, the prevailing soil, is grey in color, and is frequently intimately mixed with, and sometimes covered by, fragments of quartz rock, varying from a fine gravel to pieces of several pounds in weight. These grey soils have, apparently, been formed by the disintegration of the schistose rocks, gneiss, mica and hornblende, which cover so considerable a portion of the District. From their origin, these soils are naturally poor, and when met with on high situations where they have been subjected to the washing influences of flowing-water, they have become very poor indeed, from losing their clayey particles. A small area of country situated about 5 miles to the south of the town of Coimbatore, is covered by a calcareous soil resting over a crystalline lime-stone, and, in the neighbourhood of Coimbatore, a conglomerate lime-stone is met with near the surface but, the soils resting on it are generally very thin, and afford but little support to crops during droughts, a serious drawback in this dry climate. The land bordering the lower slopes of the Neilgherry and Annamalay ranges is, in some cases, composed largely of disintegrated rock washed down from the higher slopes, and is fertile. The soils that cover the lower ridges of hills and, the isolated conical-shaped hills which are scattered over the District, are generally very poor and thin and, in most instances almost altogether without vegetation. Considerable tracts of alluvial soil are found in the eastern and southern portions of the District bordering the large rivers but these soils are generally under irrigation.

A large area of naturally poor soil.

The elevation and fertility of soils bear a close relation.

118. As a general rule, away from the slopes of the high mountains, the best soils are found at the lowest elevations; the soils appear to be worse and worse with each increase in elevation; indeed, the soils of the District, might almost be valued according to their elevation; those in the lowest situations being valued highest and; the value decreasing with every 100 feet of elevation.

119. There is little worth special notice in the cultivation of this unirrigated land. The soil is everywhere only shallow-ploughed and, the only plough used is that common to Southern India, which, stirs the soil but, does not turn it

over. In one or two places I saw some very good cultivation, which, had been produced by digging the ground over with crowbars; by means of these crowbars the soil had been stirred to a depth of fully 12 inches. This cultivation is performed only on black soils, and during dry weather. Blocks of soil varying in weight from 10 to 20lbs. are raised and turned over; after a heavy shower of rain these fall to pieces and a fine tilth is produced. As the clods break down, the roots of grasses, especially of the Hurriallee, which are difficult to remove when the soils are under ordinary tillage, are freely exposed and can readily be collected. The effects of this crowbar cultivation are supposed to last over 10 or 12 years. The expense of turning over an acre of ground, in this way, is great; I was informed that, it took generally about 80 men one day to dig over an acre of ground, and that each of the men was paid 2 measures of grain for his work which, would represent a total cost equal to the value of 160 Madras measures of grain, about 10 Rupees. The cultivation is, I think, very perfect and leaves but little to be desired. However, the area of land thus treated, in the year, is exceedingly small; throughout my whole tour I did not see 100 acres in all, undergoing this cultivation and, my tour was in the season in which this species of cultivation is generally performed.

Deep stirring by means of crowbars.

120. A considerable area (about 300,000 acres) of the occupied land is annually under fallow; but, this so-called fallow is widely different from what is known as fallow in other countries for, the land is, in most instances, left untouched by the plough, or other implement, during the whole period it is supposed to be under fallow. Of course, as the land during the period produces no crop, it is resting for a time, but, it gains but little from those influences, from which land benefits so greatly when fallowed in a rational way.

The so-called fallow land in this country is land temporarily abandoned.

121. Nothing whatever is known by the Ryot regarding "rotation of crops" as this is understood in other countries; I say this advisedly, for I have taken some trouble in making enquiries. In some places I was informed that the Ryots did follow a rotation in their cropping but, on making further enquiry I learned that, the so-called rotation, existed only in the imagination of my informants. In one place where I made enquiries I was informed that the so-called rotation was;—cholum followed by cumboo, in each year repeated, again and again, as long as the land would continue to bear a crop. The Ryots, of course, understand that certain crops make a greater demand on a soil than others; for instance, it is common to crop land with sugarcane only every second year; while, land is cultivated with cotton in successive years, over a long period. Again, crops requiring much rain, are grown during the season of the year in which the rain-fall is usually the heaviest, and crops that can be sustained during growth by a moderate rain-fall aided by dew, are grown during that part of the year when the dews are heaviest; and, the same, in regard to temperature, some crops are grown only during the cold season when the temper-

Nothing known of Rotation of crops, as understood in other countries.

ature is low, and others, only in the hot season. A rotation of crops is based on the following;— (1) each kind of crop takes up some particular kind of plant-food, if any crop is repeated too frequently on a soil the special food on which it feeds, will become exhausted in the soil; (2) certain insects always prey on a certain description of crop, and when this crop is grown too frequently on the same ground, these insects multiply to such an extent as to become seriously injurious to it; (3) certain crops grow in an upright position and, in the light open shade they afford, give great encouragement to the growth of weeds, while, other crops form a dense shade over the ground and kill down the weeds; (4) some plants have short fleshy roots and, need, for their healthy growth, that the soil should be open and friable and, in a good manural condition, while other plants have long and numerous fibrous roots, which enable them to live and thrive under conditions, under which a short fleshy-rooted plant would almost starve. There are other reasons besides these given, for the adoption of a rotation in cropping but, neither these, nor those above given, influence the Ryot, in the management of his land.

122. Nothing is more surprising at first, to an agricultural observer, in passing through this District, than the remarkable absence of weeds on the unirrigated land. I travelled over considerable areas of land almost without a weed of any kind; however, I observed also, *that the untilled waste was almost as free from weeds.* Though I travelled several hundred miles through the District, frequently at a pace not exceeding 2½ miles per hour, I rarely indeed saw any people engaged in weeding the land. Sometimes, in a journey of 15 or 16 miles, I did not pass a single field in which there were any weeding operations going forward. The absence of weeds, on the cultivated land, cannot be attributed to the industry of the people. Annual weeds, appear to be almost unknown, excepting on the land irrigated by rivers or from wells, the long hot dry season effectually disposes of them. In several localities, I saw land which had been lying untilled for some years and which, was nevertheless almost bare and, it must be remembered that, although I ended my tour in the hot season, it was begun, in the cropping season.

Chief cereal crops.

123. The principal crops, on the unirrigated land, are cumboo (penicillaria spicata), cholum (sorghum vulgare), and raggy (eleusine coracana), these together occupy about 70 per cent. of the area of the occupied land.

Cumboo.

124. Cumboo is sown on the red and grey soils during the months of July and August, and is harvested in November and December; it occupies more of the unirrigated land than any other crop. It is grown most largely in Darapuram Taluq but, all the Taluqs produce a considerable area, excepting Oodumulpett and Collegal. The grain of cumboo constitutes the food of a considerable proportion of the people of the District, and, its straw is consumed by the cattle. Judging from what I saw, the crop is harvested only when *dead ripe*, and its straw, accordingly, will possess a much lower feeding value than it might otherwise possess.

Cholum.

125. Cholum stands next to cumboo as regards the area of land occupied. The white variety is most generally grown. It is sown and harvested in the same months as cumboo. Black or red soils are preferred for cholum. In all the Taluqs a large breadth of ground is cropped with cholum; the largest areas are in the Pollachy and Pulladum Taluqs. The grain of cholum, equally with that of cumboo, is used as human food in the District while, the straw contributes mainly to the support of the draught cattle during 9 months in the year.

Raggy.

126. Next as regards area comes raggy, which occupies annually about 150,000 acres of land. Raggy is also sown during the months of July and August, and harvested between the middle of November and the end of January. Raggy is a very important food grain and is in great demand, not only for local consumption but, for transport to the Hills for the use of coffee plantation coolies. Raggy is cultivated throughout the District, the greatest breadth of land under it being in the Collegal and Coimbatore Taluqs; its straw is also highly valued as cattle fodder.

127. In a small portion of the District where the rains of both monsoons fall, the sowing and harvest seasons are of course different to those I have mentioned. In localities so favourably circumstanced, 2 crops are frequently obtained in the year; a crop of cholum, with the North-east rains, and a crop of cumboo, with the South-west rains.

Garden varieties of cholum, cumboo, and raggy.

128. The 3 crops just noticed are grown to some extent on land irrigated from wells. Ryots distinguish 2 varieties of each, they speak of "garden cumboo" and "field cumboo," "garden cholum" and "field cholum," "garden raggy" and "field raggy." There is a very marked difference in the time in reaching maturity between plants of these so-called "garden" varieties, and those, of the "field" varieties; the former, reach maturity on the average in fully 20 per cent. less time than the latter. The garden varieties are generally matured about 15 weeks from the date of sowing, whereas, the field varieties seldom reach maturity within from 18 to 20 weeks from the date of sowing. These differences in growth are due entirely to the differences in cultivation: the so-called "garden" varieties, being always watered during growth have, from long habit, become rapid growers.

Cotton.

129. The cotton crop stands the next highest, as regards area. The following statement shows the land under cotton during each of the past 22 years;—

——	1853-54.	1854-55.	1855-56.	1856-57.	1857-58.	1858-59.	1859-60.	1860-61.	1861-62.	1862-63.	1863-64.
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
Cotton	113,919	116,527	135,920	91,053	113,663	131,711	120,086	132,233	88,910	132,684	207,646

	1864-65.	1865-66.	1866-67.	1867-68.	1868-69.	1869-70.	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
Cotton	157,856	110,635	115,529	119,247	117,680	121,288	142,118	142,237	178,660	195,307	193,464

130. The annual production of cotton lint in Coimbatore, is estimated to be about 22,000 bales of 400 lbs. each. The consumption of cotton within the District is estimated at 5,000 bales, leaving about 17,000 bales for export: The cotton produced is chiefly sent to Beypore for shipment.

131. Very little cotton is grown in the northern and western portions of the District. The largest area is grown in the Taluqs of Erode and Darapuram.

132. The black and red soils are usually preferred for cotton cultivation, probably because these soils are capable of taking up, and holding, a large quantity of atmospheric moisture which, enables plants growing upon them, to survive the effects of a long drought. Clear dry hot weather, must be secured for the cotton harvest, in order to obtain a good yield of lint, both as regards quality and quantity.

Dry clear weather good for cotton harvest.

The weather experienced in Coimbatore during the months of January, February and March is particularly favourable for the cotton harvest; but, from its extreme dryness, plants growing on soils, approaching in composition sandy soils, die off; hence, in order to secure his cotton harvest, in this dry weather, the Ryot is compelled to sow cotton on moderately retentive soils. Mr. Schiffmayer's experiments, referred to in the accompanying Report of the Sydapet Experimental Farm, shows that, a black cotton soil is capable of holding more than one-third of its entire weight of water; and that, it has, in a very remarkable degree, the power of absorbing moisture from the air; he found in an ordinary cotton soil 9·43 per cent. of moisture and, in one of sandy soils of the Experimental Farm, only $\frac{3}{4}$ per cent. of moisture, after both soils had been equally air-dried; and, he found further, that the air-dried samples, on exposure to the atmosphere during night absorbed, the black soil, $1\frac{3}{4}$ per cent. of moisture, and the sandy soil only $\frac{3}{4}$ per cent.

Black cotton soil great power of absorbing and retaining moisture.

133. In portions of the District watered partially by the rains of both monsoons, I am inclined to think that the calcareous soils will, under the rude agricultural practice of the District, yield heavier crops of cotton than the soils on which it is usually grown. The celebrated crop, grown by a former Collector of Coimbatore, Mr. Wroughton, which, on 30 acres of land, yielded 25,000 lbs. of seed cotton, was produced on a calcareous soil resting on a crystalline limestone. Mr. Wroughton, attributed the large crop to the effects of the favorable rains, which the land secured, from its position directly opposite the Palghaut gap, and therefore, securing the benefits of the rains of both monsoons. I had an opportunity of inspecting this land, and would attribute the large crop, to the quantity of lime the soil contains, quite as much as, to the favorable climatical conditions of

Calcareous soils yield well under moderate but regular rain-fall.

the neighbourhood. However, calcareous soils are not met with to any great extent, and such soils if situated in the drier parts, would not be likely to produce good crops of cotton, unless aided by irrigation water. Both the black and red soils would, I am sure, yield very much larger crops of cotton if manured with lime. It is true that, some of the black soil contains nodules of limestone but, the action of lime in this form is exceedingly slow and very limited, in comparison with the action of lime that has been prepared by burning.

134. Cotton is sown generally in the months of September, and October and, the crops are gathered during January, March and April; those I saw were very poor indeed; the people said that, an average crop was from 200 to 250 lbs. of seed-cotton, which gave from 50 to 60 lbs. of clean lint. I certainly saw no crop that seemed likely to produce more than 70 or 80 lbs. of clean lint, per acre; and I saw considerable areas of land, under cotton, from which it seemed to me probable that the yield of clean lint would not be 50 lbs. per acre.

135. Coimbatore cotton is noted for its whiteness; but, its staple is very short. I learn that, there are yet traces in the cotton from some portions of the District, of the Bourbon and New Orleans varieties that were introduced by the Government Cotton Farms upwards of 30 years ago. However, the traces are but slight; which, perhaps is not surprising, seeing how cotton culture is conducted by the Ryots.

Traces of Bourbon cotton in the District introduced by Cotton Farms.

136. Cotton is grown, year after year, on the same land. Cotton land is *never manured*, and, not only is the seed and lint removed, but also, the whole of the plant. The cotton seed is given as payment for cleaning the cotton, or, it is sold; it is rare indeed that it is used for feeding the cattle attached to the land, on which it was raised. Much of the seed is consumed by the cattle employed on the roads, chiefly by those employed in connection with the Neilgherry traffic and, a considerable quantity of the seed is sent to the Neilgherries.

Cotton land never manured and only half tilled.

137. Cotton cultivation appears to be very unpopular. I was frequently informed by Ryots that, they look upon cotton as a *very unprofitable crop*. That this should be so, is not surprising if, as is generally stated, the yield of clean lint throughout this District is on the average less than 50 lbs. per acre, for, *the 50 lbs. would not be worth more, in an average season, than Rupees* 10; and, it must be remembered that, unlike the majority of the crops grown by the Ryot, the cotton crop yields no fodder for cattle while, it is an expensive crop to harvest. I enquired frequently from the Ryots why, if the cotton crop paid so badly, they occupied their good soils with it, to such a large extent, their general reply was, that they grew the cotton, in order that with it they might pay the assessment on their land. I asked why they could not grow grain, which, would give a larger money return on land of the quality required by cotton, in reply they said that, if they grew nothing but grain *they would have nothing wherewith to pay*

Cotton cultivation unpopular.

Government rent as, they and their families could and would consume the whole produce of the land, they, having to content themselves, at present, with only 2 meals of food, per day, instead of 3; *that, as they could not eat cotton, it was therefore available, with which to raise money for paying their rent.* They asserted that most of the Ryots who hold less than 10 acres of dry land, could consume in their own families all the grain their land produced. I asked how men who grew no cotton whatever, managed to live and pay their annual rents, to this they replied that, men, who had no cotton land, frequently had wells and, with the aid of the well-water they grew tobacco, chillies, &c., and by the sale of which they raised money to pay the rent, and where there were no wells the cultivators bred cattle for sale, from the proceeds of which they obtained money to pay the rent. There is, I think, a good deal of truth in this; however, it should be remembered that under the system of barter practised, the Ryot can, with grain, procure everything he needs, as readily as, if he had the money the grain represented; hence his domestic demand for grain may be much larger than would suffice for the actual food of his household. In the open market, cotton is as easily bartered away; but for the every-day wants of the family, cotton is not nearly so acceptable an exchange as grain.

138. On an ordinary holding of 10 acres of unirrigated land, farmed in the usual way, the crop would not yield more than 1,500 Madras measures of grain in the year which, deducting 10 per cent. for waste, &c., would represent an allowance during a year, of about $3\frac{3}{4}$ measures per day. In the Coimbatore Jail, the food allowed to each male adult consists daily;—

	Ounce.
Cholum	24
Dholl	2
Mutton	5
Vegetable	6
Salt and condiment	5
Total daily ...	42

The total allowance of food is 42 ounces, but it must be remembered that the grain is without husk, adding this, the total daily allowance amounts to fully 46 ounces, which would be about the weight of $1\frac{1}{2}$ measures of cholum or cumboo, which, would not contain so much nutriment as the jail allowance; in a family of 2 adults and 4 children fed on cholum or cumboo, the daily consumption at $1\frac{1}{2}$ measures for an adult male, and $\frac{1}{4}$ of a measure for an adult female, would be for the parents 2 measures, and about $1\frac{1}{2}$ measures for the children, total daily consumption $3\frac{1}{2}$ measures. From this it would appear that the produce of the 10 acres, would be just sufficient to feed the family throughout the year, and leave a trifle for bartering for cloths, &c., if, the members of the family, were as well fed as the convicts usually are; but, in that case there would be nothing available for the payment of rent, &c., hence, the necessity for restricting the diet to 2 meals in the day, and, in this way setting free $\frac{1}{3}$ of the money value of a full diet, for the payment of rent and,

the other charges which, even the humblest Ryot has to meet. It will be seen thus, that there are good grounds for believing the statement made by the Ryots, noticed in the preceding paragraph.

139. Cotton might be produced to any extent in the District of Coimbatore, the climate is admirably suited for cotton culture, and there are large areas of soils, which would produce it heavily under good farming.

Pulse crops.

140. The next important crops are the pulses, Horse-gram (dolichos uniflorus), Mutchehcottay (Lablab vulgaris), Bengal gram (cicer arietinum), Black gram (phaseolus roxburghii), Green gram (phaseolus mungo), Dholl (cajanus indicus). Together these pulses occupy annually about 220,000 acres of land. Horse-gram is the most important, it occupies, about three-fourths of the entire area under pulses. Horse-gram is grown to some extent in all the Taluqs but, chiefly in those of Pulladum and Coimbatore. There is a large demand for this pulse for the Hill markets. Mutchehcottay occupies the next highest area, about 25,000 acres, it is grown chiefly in the Taluq of Darapuram. The area under the other pulses referred to is, in each instance, about 10,000 acres annually.

Horse-gram.

Shamay, Tenney and Varagoo.

141. The cereal crops Shamay (panicum miliare) Tenney (panicum italicum) and Varagoo (panicum miliaceum) are grown to some extent. Together they occupy, in the year, about 150,000 acres. Shamay is grown in all the Taluqs, but chiefly in those of Coimbatore and Pulladum. The cultivation of Tenney is confined almost entirely to the Coimbatore Taluq, and that Taluq also produces the largest area of Varagoo.

Oil producing crops.

142. The area annually under crops that produce seed, yielding oil, is about 80,000 acres. The varieties chiefly grown are Gingelly and Castor, the former, occupies about 55,000 acres and the latter about 25,000.

143. Several other crops are grown on the unirrigated arable land but, from the small area they occupy, they are not of much importance.

Grass land.

144. An exceedingly small proportion of the occupied area is under grass. I saw some fair pasture near Othikkalmundapum in the Coimbatore Taluq, and also, a few patches of middling pasture in the Pollachy and Kongiem Taluqs but, elsewhere in the District, excepting on the slopes of the Annamalays and Neilgherries, on the banks of the larger rivers, and, on the margins of irrigated land, I saw nothing that could be called "grass land." Over the greater part of the country, there is not, in each 1,000 acres of occupied land, more than one acre under pasturage.

Almost entire absence of pasture land.

145. The almost entire absence of pasture land, is a serious defect in the agriculture of this District. The temporarily abandoned arable land, is recognized as "grass land" in the Revenue Classification; this is, I think, a grave error for, it is calculated seriously to mislead. In all countries, "grass land" is understood to be land which is covered by grass, either throughout the whole year or, during a considerable portion of the year. Now, much of the so-called grass land in the District is altogether without grass,

being almost as bare as the high-way. A country, which has a large area of *grass* land, is in a much safer condition than, a country in which all the land is under arable husbandry.

146. We are told that, " grass land " occupies, at the least, 10 per cent. of the occupied land of this District; such a statement, does no harm when it is understood that, this so-called " grass land " may be land which is altogether destitute of grass but, without this special knowledge, the statement is certainly misleading. I saw a good deal of this so-called " grass land " and, much of it would not, I am sure, yield a barrowful of grass, roots and plants included, per acre. The season had certainly been an unusually dry one, however, this would not account for the poverty of vegetation on the land.

147. In some instances land is specially set apart by the Ryot for the production of grass. I saw some of this land which had been so reserved for periods varying from 10 to 30 years, and, in no instance, did I see anything approaching a sward. In most instances, the grass grew in low tufts which, were scattered over the ground at distances of from 6 to 12 inches, the intervening spaces being quite bare. The grasses, seemed generally to be perennial species; I seldom saw annual grasses or, other annual plants, growing amongst these grasses. I saw one piece of pasture land which, had been under grass for more than 30 years and I am quite certain that if the whole of the produce on the land was *scraped* off, it would not have amounted to 200 lbs. per acre.

148. The Ryot never manures his pasture land and, he crops it incessantly with cattle, sheep and goats as long as these animals can obtain a scanty support on it. The only time when this pasture land is allowed rest, is during and after heavy rain when, the grass, which then springs up, is considered to be noxious to live stock. The grasses are thus never permitted to produce seed or, only to a very limited extent, and hence, much of the ground remains bare.

149. Ryots know nothing whatever about raising grasses from seed. When pasturage is desired, a piece of arable ground is left untilled and, in the course of a few years it becomes covered here and there with scanty tufts of herbage. No attempts are ever made by planting the roots of grasses or, by sowing the seeds of grasses, to improve this scanty pasturage.

150. Not only are the circumstances bad under which land is laid down to grass but, the whole of the subsequent management of the grass, is the very opposite of that under which good results might be achieved. Land when once covered by a scanty pasturage, such as I have described, is abandoned, as far as acts of husbandry are concerned.

151. The consequence of this mismanagement of the grass lands is a serious deterioration in the live stock. It would be impossible that anything else but deterioration, could result to live stock raised on these exhausted grass lands; if the grass does not in itself afford the food required by the stock during growth and, the special food required is not supplied by other means, the *result must be an*

animal of stunted and imperfect form. Ryots speak with pride of a period 20 or 30 years ago when they possessed fine breeds of cattle and horses, the loss of which, they attribute to the almost total disappearance of grass in the cropping of the District.

152. Ryots complained bitterly about a change in the assessment of land, made some years ago, under which most of their best grass lands were brought under the plough. I have not been able to procure any exact data but, the assertion generally made was, that before the change in question took place, Ryots were permitted to hold grass land at one-fourth of the rent paid for tilled land, without fear of any one taking the land from them. I understand from information, afforded me by the Board of Revenue, in their Proceedings, No. 3,044 of the 2nd December 1876 that, Ryots are still permitted to hold the so-called "grass land" at one-fourth the annual rent payable for their arable land *provided, no person is willing to take up the land for arable culture at the full rent.* The effect of these rules is, to restrict grass to such soils as are not, in the estimation of the Ryot, competent under arable culture to afford even that wretched return, with which he is usually satisfied and, *to induce the breaking up of grass land, whenever its condition is such as to promise a good return under tillage.* Under circumstances such as these, it is not surprising that, good pasturage should be unknown.

153. To produce a good pasture is a difficulty even in England, where the climate is all that could be desired for the growth of grass. In that country, the soil intended to be laid down under pasture is prepared in a most elaborate way: seeds of the varieties of grasses likely to succeed best on the special soils to be sown, are selected, and are sown under conditions calculated to secure good results, the soil being previously put into a good manural condition. In the after-management, the greatest care is exercised.

154. In Great Britain much money is expended on labor and manure, under skilful management, in the laying down of land under grass. There is perhaps no work of the farmer which demands to be more thoroughly performed, than that connected with the laying down of land under grass for pasture. And yet, in this country, with its unpropitious climate, the production of pasturage is supposed to demand nothing from the Ryot but, to result from natural agencies, which, are not one-hundredth part so powerful for good, in the direction required, than are such agencies in England.

155. Such pastures as we have in England could not be produced in Coimbatore, on the unirrigated land, but, moderately good pastures could be produced by the Ryot, if he adopted a better system of husbandry.

156. On the land watered by wells, there would be no difficulty whatever in producing good pasturage; there are many grasses well suited for cultivation under such condition as could be afforded. If the Ryot could be induced, to lay down under grass annually, a portion of his land irrigated from wells, and, to graze this land by his live stock, the soil would be improved for,

the next 2 or 3 succeeding crops, and on the removal of these, the land might again be put under grass. Or, some of the vast volume of water wasted on the paddy crop, might be diverted to land on which grass might be produced. The extraordinary crops of grass produced in the neighbourhood of Madras under occasional irrigation, shows what can be done in this direction.

Unirrigated land diminished in productiveness 30 per cent.

157. Throughout the District, the Ryots agreed in stating that, the unirrigated land has diminished in productiveness fully 30 per cent. during the past 25 years. Many of the men whom I consulted, possessed river-irrigated land as well as unirrigated land and, as these men, without an exception, stated most positively that there was no change whatever in the productiveness of the river-irrigated land during the period in question, we may, I think, accept their testimony as true, especially, as everything tends to support its truthfulness.

158. I took special pains to sift statements made regarding the deterioration in the fertility of the land and, I could come to no other conclusion but that *this deterioration has taken place and to a very alarming extent;* while, it appeared to me equally certain that, the influences which have brought about this result are not only still in operation but, are now operating in a much more intensified form.

Decrease of reserved area and increase of tilled area.

159. I have before pointed out that, the large area of land which, previously to 1855, was untilled, was the reserve which enabled the Ryots to treat their arable land in a somewhat better way, than is now the usual practice; chiefly, by enabling them to keep more stock.

Great diminution in the live stock of the District.

160. Everywhere where I went, the Ryots declared that there has been a great diminution in the live stock of the District. Since returning to Madras, I have carefully examined the statistics of Coimbatore and, I have ascertained that, *in the last* 30 *years, the area under occupation has been increased* 50 *per cent. while, there has been but little change in the number of live stock;* hence, compared with the area of land now under occupation there has been a large decrease. The following statement, shows this;—

Official Year.	Number of Ploughs.	Area of occupied land.	Number of head of Cattle.	Number of heads of Cattle per 100 acres of occupied land.
1838-39 ...	71,381	999,334	657,766	65·82
1839-40 ...	73,193	1,024,702	658,264	64·24
1840-41 ...	74,540	1,043,560	654,254	62·69
1841-42 ...	77,758	1,088,612	644,777	59·23
1842-43 ...	79,485	1,112,790	656,369	58·98
1843-44 ...	80,314	1,124,396	659,935	58·69
1844-45 ...	81,918	1,146,852	661,783	57·70
1845-46 ...	83,916	1,174,824	633,726	53·94
1846-47 ...	84,362	1,181,068	628,799	53·24
1847-48 ...	85,531	1,197,434	633,956	52·94

Official Year.	Number of Ploughs.	Area of occupied land.	Number of head ofCattle.	Number of heads of Cattle per 100 acres of occupied land.
1848-49 ...	86,716	1,214,024	641,735	52·86
1849-50 ...	87,103	1,219,442	655,456	53·75
1850-51 ...	88,055	1,232,770	697,666	56·59
1851-52 ...	88,598	1,240,372	726,192	58·55
1852-53 ...	...	...	...	...
1853-54 ...	...	...	...	...
1854-55 ...	...	...	...	...
1855-56 ...	...	...	...	...
1856-57 ...	*105,339	1,474,746	484,445	32·85
1857-58 ...	...	...	...	...
1858-59 ...	...	...	...	...
1859-60 ...	...	...	...	...
1860-61 ...	...	...	...	...
1861-62 ...	*124,421	1,741,894	628,935	36·11
1862-63 ...	...	...	...	...
1863-64 ...	...	...	...	...
1864-65 ...	...	...	...	...
1865-66 ...	...	...	...	...
1866-67 ...	*147,289	2,062,046	675,340	32·75
1867-68 ...	...	...	...	...
1868-69 ...	...	...	...	...
1869-70 ...	...	...	...	...
1870-71 ...	...	...	...	...
1871-72 ...	*173,011	2,422,154	773,663	31·94

I was unable to procure the area under occupation, in each of the years, for the whole of the period to which the statement refers but, as I possessed statistics giving the number of ploughs, in most of the years in question, I have been able, to some extent, to supply this deficiency. By multiplying the number of ploughs, in each year, by 14, I obtained the area of occupied land. It will be seen from the following that, each plough represents 14 acres of occupied land ;—

Official Year.	Actual area under occupation.	Actual number of Ploughs.	Area under occupation for each Plough.	Average number of acres for each Plough.
	ACRES.		ACRES.	
1861-62 ...	1,776,971	124,421	14·2	14·1
1866-67 ...	2,199,089	147,289	14·9	
1871-72 ...	2,293,926	173,011	13·2	

The number of cattle was determined, by adding in each year, to the actual number of cattle, one-eighth of the number of sheep (8 sheep being estimated as equal to 1 head of cattle). It will be seen that *in the official year* 1838-39 *there were for each* 100 *acres of occupied land,* 66 *head of cattle, whereas, in* 1871-72 *there were only* 32 *for the same area.* It must be remembered that the average live weight of one of the cattle referred to, is not more than 350 lbs. *which, is only the weight of an average sized Cotswold sheep.*

* Now counted only every fifth year.

161. I must again point out that I do not look upon the increased area of arable land as an evil in itself but, it is undoubtedly a great evil under the circumstances I have mentioned. As long as the arable land consisted only of the more fertile portions of the country, and as long as that arable land was, to a great extent, supported by the manure of cattle, fed in the untilled portions of the District, so long were the Ryots able to support themselves by their rude agricultural practice. It is clear, that if the arable land did not receive fair treatment as regards manure, when there were 66 head of cattle for each 100 acres of occupied land, it cannot receive justice now, when for each 100 acres, the number of cattle is only 32. But, not only has the manuring force, as represented by cattle manure, diminished to one-half but, even of that, not more than 50 per cent. is now available as manure, from the great increase in the use of cattle dung as fuel, since the clearing of the jungles. The consumption of cattle dung as fuel is now very large.

Large consumption of cattle dung fuel.

In many native households in Towns, fully one-third of the fuel used is cattle dung. From information I have been favoured with, it would appear that, in Madras, the consumption of cattle dung bratties, amounts to about 100 per mensem, for each adult, in many middle-class native households. In a family consisting of 7 adults and 4 children, 800 bratties are used as fuel in a month, in another family consisting of 3 adults, the monthly consumption is 400 bratties; in another household, consisting of 3 adults and 3 children, the consumption of this fuel is 400 bratties per mensem; in another, consisting of 4 adults and 2 children, the monthly consumption is 400 bratties; in another, consisting of 2 adults and 6 children, the consumption is 450 bratties per mensem; and, in another household consisting of 2 adults, the consumption is 300 bratties monthly. The dung of one average sized bullock would, in a month, collected during the night only, make about 120 bratties. During the dry season an average sized plough bullock, and an average sized cow, yielded at night in a month, a quantity of dung that made, in the first instance, 90 bratties and, in the second, 120; and during some experiments made on the Sydapet Experimental Farm, with the large bullocks used there, it was found that the dung of two bullocks, in 2 months made 734 bratties which was equal to 183 per head, per month. It would therefore appear that in many native households the consumption of cattle dung as fuel, is equal to that obtained from 1 bullock, for each adult forming the household. It is true that, this quantity of dung cannot be used in all households for, the cattle in the country would not nearly suffice to meet such a demand. However, the facts, show to what a large extent cattle dung fuel is used. As fuel is as costly in most parts of Coimbatore as it is in Madras, and as the habits of the people are similar, there cannot be a very great difference in the quantity of cattle dung used; if there is a difference, the probability is, that the consumption of cattle dung is greater in Coimbatore, from it being more accessible to the people.

162. Few people have any idea of the enormous consumption of fuel in our rural districts. I was informed, at one small Town that its population, under 7,000,

used monthly 4,000 bundles of 50 lbs. each of jungle fuel, which is equivalent to upwards of 1,000 tons, per annum or, the produce of at least 100 acres of well grown scrub jungle; besides the jungle fuel referred to, the inhabitants of this Town used a large quantity of cattle dung, the stems of cotton plant, &c. These figures show that the average monthly consumption of jungle fuel per inhabitant of the Town, is 28 lbs.; in the Coimbatore Jail, the monthly consumption of fuel, per prisoner, is 60 lbs.

Large consumption of jungle fuel.

163. As a general rule, Ryots do not readily admit, when asked for the first time, that they do not use manure, it is only after a judicious cross-examination that the fact, that they do not use it, excepting, to a very limited extent, is brought to light: thus :—

Q.—Do you use manure?
A.—Yes.
Q.—What sorts of manure do you use?
A.—Sheep manure and cattle manure.
Q.—Do you use any other kinds of manure?
A.—No; excepting occasionally a small quantity of village sweepings, and, for wet land, Kolinjy and Auvaray leaves.
Q.—How many acres do you hold?
A.—40.
Q.—Is it all arable land?
A.—Yes; all ploughed.
Q.—How many sheep and how many head of cattle have you?
A.—20 sheep and 6 head of cattle.
Q.—Do you use cattle dung as fuel?
A.—Yes.
Q.—What proportion of the cattle dung do you use as fuel?
A.—About half.
Q.—How do you manure your land with the dung of the sheep and cattle?
A.—We generally fold the sheep and cattle on the land in pens at night.
Q.—Are the whole of your sheep and cattle kept in one fold
A.—The sheep are all in one fold and the cattle are generally tethered to the fold on the outer side.
Q.—Do you give your sheep and cattle any special food when folded on the land?
A.—Not the sheep but, the cattle get a little cumboo or cholum straw.
Q.—What size is your fold?
A.—7 yards square.
Q.—The cattle I observe are tied outside of the fold; is this always the case?
A.—Yes, generally.
Q.—Then, the area manured by the cattle tied outside of the fold and by the sheep within the fold must be equal to about 100 square yards, which, will represent the area manured between each time the fold is removed.
A.—Yes.
Q.—How often do you remove your fold?
A.—Every second day.

Q.—Then; it is evident that you will manure only 100 square yards of land in two days, or, in a month, 1,500 square yards or, in a year less than 4 acres. How do you manure the remainder of your land?

A.—We cannot manure it, it goes without manure.

Q.—But, you said that you manured your land, whereas, the fact appears that nine-tenths of it is unmanured. How do you explain this?

A.—I have 8 acres of garden land and this gets the whole of the manure. I never manure dry land. Dry land is never manured, unless, when the cultivator only has dry land, in which case, his dry land gets what manure he has.

Q.—Then, you mean to assert that dry land is never manured except, under the exceptional circumstances you have mentioned?

A.—Yes. All the manure goes to the garden land, the dry land is cultivated without manure.

The foregoing is compiled from notes taken at conversations held with Ryots and, is representative of many.

164. It was only by putting fact, with fact, that I was able to come to any conclusion, on many of the questions that presented themselves during my investigations. After having ascertained the number and description of stock kept in, or, at a fold, the number of these folds on a holding, the area manured between each removal of the fold and, how long the fold remained in one place, it became a very easy matter to calculate how much land could be manured in the year on the holding.

165. I measured many sheep-folds, the majority of them covered an area of only 50 square yards, and, on the average, they contained 20 sheep and goats of all ages, in addition to the animals inside the fold there were, on the average, 3 head of cattle tethered on the outer side.

166. The sheep of the District are used almost entirely for manuring purposes. There were in 1871-72 850,227 head of sheep and goats, dividing these in pens of 20 each, 42,511 would be required, the animals at each pen, inside and outside, would together manure 100 square yards of ground, we must therefore multiply the number of pens by 100 which gives 4,251,100 square yards or 878 acres as the area manured in 2 days, assuming that, on the average, each pen is moved every second day. From these calculations it would appear that, if folding was practised universally throughout the District on the arable land, *only* 158,000 *acres of land could be manured in the year* and that, to do this, the whole of the sheep and goats and, one-fourth of the cattle would be required. Making every allowance for the dung of the remainder of the cattle stock available as manure and, deducting the manure lost at the seasons of the year when folding is unadvisable, or impossible, it is clear that *the Ryot cannot manure in the year more than* 200,000 *acres of land by the dung of sheep and cattle.* Assuming that, the efficacy of the manuring obtained from folding, operates during 2 years, there will be altogether not more than 400,000 acres benefitting from the manure of sheep and cattle, *leaving more than one and three-quarter million acres of the unoccupied land altogether unaided by manure*, thus 75 per cent., at the least, of the occupied land is never influenced

Sheep used for manuring purposes.

Vast area of occupied land farmed without manure.

by manure. It must not be supposed that the 25 per cent. except the portion irrigated from rivers, is manured in a satisfactory way; the foregoing calculations take no cognizance of the *quality of the manuring*, they show only the area that can be manured under the practice generally followed in folding. I have already directed attention to the imperfections of the folding system.

Nothing known about mineral manures by Ryots.

167. The Ryot of Coimbatore knows nothing whatever of the use of mineral manures. The soils greatly need lime, potash, and, nitric acid yet, these plant foods are never directly applied to the soil by the Ryot, even though, lime and saltpetre are available at prices sufficiently low to justify their use; indeed, so moderate is the price of saltpetre that it is being largely exported for use as a manural agent; if, it pays the British and Continental Farmer to use Indian saltpetre as a manure, surely it would pay the Coimbatore Farmer to use it to some extent, at any rate, in the production of those more valuable crops tobacco, sugarcane, wheat, &c., which, feed so largely upon potash and nitric acid, and which, are now grown to such a very limited extent, not from any fault in the climate but, from the general neglect of manuring. It is true that, the Ryot cannot afford to use these expensive manures in raising crops of the inferior cereals but, in the cultivation of the crops I have mentioned, the can well afford to use them.

LIVE STOCK.

Horses.

168. I did not see a good specimen of either a country-bred horse or pony in the whole District, away from the neighbourhood of large towns. From what I had heard, I was lead to expect that, in the Kongiem Taluq, at any rate, I would see some fair specimens of country-bred horses and ponies but, even in the Kongiem Taluq I did not see a country-bred horse or pony that would, at a Madras auction, sell for 50 Rupees, and I am sure that the majority of those I saw, would have been dear at only half this price. In all my experience I never saw together such a number of undersized wretched-formed brutes as I saw at the Kongiem fair. The average jutka pony of Madras is quite equal to the best of the country-bred ponies of the District that came under my observation. In the Southern Taluqs undersized horses or, large ponies are used for riding, these, generally, are about 13 hands in height and are flat-sided, narrow-chested, long-legged animals; nearly every one had crooked, deformed legs. Yet, I was informed by many Ryots that, at one time, Coimbatore bred some really good horses with which the army was supplied; indeed, it is on record in the Proceedings of Government that, even as recent as 30 years ago, the District possessed many really good horses. The Ryots attribute the decline of horse-breeding during the last quarter of a century first, to the absence of good grazing so much of the grass-land having been broken up, and the soil under grass being now so unproductive from insufficient rainfall; and, from the discouragement to local breeding by the army now being supplied almost entirely with horses imported from other countries.

Coimbatore at one time bred good horses.

169. Government have, at different times, endeavoured to improve horse-breeding in Coimbatore. In 1831, they sent from Oossoor 4 stallions to travel through the District; and, from that year up to 1847, the District was seldom without any Government stallions. Recently 2 stallions, a horse and a pony were placed at the services of the horse breeders but, the results of the experiment have not been deemed satisfactory. My own impression is that it will be of but little use to place well-bred stallions at the services of horse breeders of this District, until the agricultural practice generally has been very materially improved. There is but little natural pasturage suitable for raising horses, excepting on the slopes of the Annamalays and, Neilgherries, and, the pastures there, are unfitted for grazing horses, from the rough, irregular surface of the ground.

Before horse-breeding can be restored to its former footing better farming must be practised.

170. Horse-breeding can be conducted successfully in this District only when proper crops are raised for the use of horses. The climate of some parts seems suited for horse-breeding, and over a considerable portion, there would be no difficulty whatever in growing lucerne and other green crops, as fodder for horses while, good pasturage could be provided if proper means were taken.

Must provide fodder or grazing for horses.

171. Until a decided change for the better has taken place in the agricultural practice of the Ryot, mule-breeding would, I think, be attended with much more success than horse-breeding. Of course, the mares would need to be maintained in good condition, whether they are used for horse-breeding or for mule-breeding, but, the stallion asses would be maintained at a much less expense than entire horses and, the young mule would thrive under conditions that would prove highly detrimental to young horses. If mules could be produced, at a moderate price, they would be in great demand, not only for use on the Neilgherries, for coffee estates and for the passenger traffic, but also, on the Plains. The mares that I saw in Coimbatore, were certainly not such as would produce good mules but, they would produce better mules than horses. If Government action is necessary, it would, I think, be attended with more success if, brought to bear in the direction of mule-breeding, than of horse-breeding, under the present condition of agriculture in the District.

Mules might be reared in the district.

172. The best cattle are found in the Kongiem, Sattiamangalam and Pollachy Taluqs. The cattle of the northern portion of the District resemble very much the Mysore breed excepting, as regards size. In the southern portion of the District, the cattle more nearly resemble the Kongiem breed. The best cattle are, generally, owned by carters, employed on road traffic, more especially in connection with that of the Neilgherries. It was very seldom indeed that I saw any good cattle on Ryots' holdings. I was much disappointed during my tour in the Kongiem Taluq, with the cattle that came under my notice there, from what I had heard of the Kongiem breed, I had expected to see some good stock, in the Taluq from which the breed had taken its name but, throughout the Taluq, the cattle are now in no respect better than are those of the

Cattle.

neighbouring Taluqs. At the Kongiem fair, I saw congregated together several hundred head of cattle, and amongst these, excluding those belonging to carters, there was not perhaps a dozen animals that in Madras would sell for 40 Rupees per head but, even these, afforded evidence of the qualities of the breed, though now, so greatly degenerated. In the carts on the road between Caroor and Kongiem, I frequently saw some very well-shaped cattle which, were said to possess most of the points of the Kongiem breed. These animals were low-set, square, deep-framed and broad-loined. In color, they were generally red but, I saw some of all the usual cattle colors. For light draught either on the road or in the field, the cattle of this breed appear to be well adapted, and they are active and hardy.

Kongiem breed almost extinct in the breeding districts.

173. It would be a great loss to the agriculture of this country if, the Kongiem breed of cattle should be allowed to become extinct. The Kongiem Ryots who formerly bred cattle said that, they had ceased breeding them from the impossibility now of rearing moderately good animals, except by feeding with grain, and this, they could not afford to do. They informed me that, during the past 10 or 12 years, the breed of cattle for which their Taluq was formerly so famous, has been gradually disappearing. They said that this was due, to the smaller area of grass-land, to the unproductiveness of grass lands during the past few years from the deficient rainfall, and, to so many of the best breeding animals having been sold, the breeders being too poor to keep them. So low has cattle-breeding sunk in this Taluq, from the causes above mentioned that, instead of, as formerly, supplying the neighbouring Taluqs with cattle, Kongiem now obtains most of the cattle required for its own tillage operations, from Sattiamangalam and the adjoining Taluqs. The undersized bullock of Southern India is gradually displacing, even in Kongiem itself, the once famous Kongiem breed; the Ryots find that they can buy these inferior animals at from 8 to 12 Rupees per head whereas, under present conditions, they could not breed and rear a bullock at twice the sum, seeing that, the grazing would need to be supplemented by an allowance of grain. Unfortunately many of the Ryots, seem to consider it better policy to buy a pair of these ordinary undersized plough-cattle, at say 20 Rupees, rather than to expend 20 Rupees, in breeding and rearing a bullock of the Kongiem breed. All they appear to see is that, they can purchase 2 cattle, for the sum that it would cost to breed and rear one; they do not seem to appreciate the saving in cattle-food and in laborer's wages, when 1 pair of cattle does the work of two pairs.

Kongiem now imports cattle from the other taluqs.

The inferior plough bullocks of Southern India displacing the Kongiem breed.

174. In the parts of Kongiem, where cattle are yet bred, they are reared on such grass as they can meet with, aided with an occasional allowance of straw; but, during the 2 or three months before it is intended to offer the animals for sale, they receive daily a small allowance of grain or, in the case of the poorer cultivators, a small daily allowance of the meal of acacia seed. No crops are reared specially for cattle, either in Kongiem or in other parts of Coimbatore.

175. I attended several cattle markets during my tour; in some of these I found bullocks 4 and 5 years old being offered at from 7 to 10 Rupees per head. The fact that a bullock after 4 or 5 years' rearing, will sell at only from 7 to 10 Rupees shows how small is the return from cattle breeding, when managed in the ordinary way by Ryots. I was told by several of the Ryots who had bred cattle that, for a bullock of the ordinary low country breed 5 or 6 years' old, it was rare that they ever obtained more than 15 Rupees per head, and that, at this price they were generally losers.

176. In the hot dry season, the cattle on the land skirting the hill ranges are sent to be grazed on the higher slopes hence, in these localities the cattle are better than those in other parts. The cattle employed on the roads are much better fed than those employed in ordinary agricultural labor; at the various halting places and, in the markets, cholum, both green and dry, was regularly offered for sale, for the use of cart-bullocks. If the Ryot could be induced to maintain his breeding stock in as good condition as the cart-bullocks, there would be but little to complain of.

Cows badly fed.

177. As a general rule, the cows are half-starved; as a consequence, of this mismanagement, but little milk is obtained. During the 2 months after calving, it is usual to remove only about one-half of the milk, the remainder being left for the calf but, afterwards, all is removed, excepting the strippings which the calf is allowed to get. In some places, the practice is to allow the calf to get all the milk during the first 2 months and, half of the milk afterwards.

178. A good cow of the Kongiem breed, will give in the height of the grass season when in full milk, 1½ Madras measures, equal to a little more than 2 quarts daily but, the general average is not more than 1 measure (3 pints) daily, even under favourable circumstances and, the cow, seldom gives milk for longer than 6 months after calving.

No means for checking spread of disease.

179. Throughout the District, during the time of my tour, the cattle were affected by foot-and-mouth disease. In all the markets might be seen standing side by side, healthy and diseased stock. The Ryots appear to attribute but little importance to the foot-and-mouth disease, they said that, they only lost young calves and sickly animals by it but, admitted, that bullocks attacked by the disease, were always brought into a very low weak condition while, the cows lost their milk. However, the Ryots are so accustomed to see their cattle in low condition, that they take but little account of the effect of the disease when, loss of condition is the only result.

Sheep.

180. There are two well defined varieties of sheep in Coimbatore. Throughout the District generally, the sheep are the long-legged, red-colored, hairy animals, of a goat-like appearance, common to many parts of Southern India. In the neighbourhood of Coimbatore, there is a small variety with white wool, and black faces and legs, these in general appearance resemble very much, diminutive South Downs.

181. The reddish colored sheep are said to yield good mutton: when in good condition, an average sized sheep will yield about 25 pounds. When fit for killing, these sheep sell for from 2 to 3 Rupees per head. They are seldom kept in large flocks but, most of the Ryots own a few which, they fold on their land.

182. The white-wool breed is found chiefly in the Coimbatore Taluq. Sheep of this breed, are nearly always owned by persons who depend solely for a livelihood on the income the sheep bring in, when used for manuring land. Generally these sheep are in large flocks. They yield a short white wool which, though of only an indifferent quality, meets with a ready local demand, for manufacture into cumblies and blankets, which are largely used by the tribes inhabiting the Hills bordering the District. The yield of wool is seldom more than 1 lb. per head, hence the flock owners attach but very little importance to it; neither, do they attach any importance to the mutton-producing capabilities of the breed. The sheep are kept as manure producers, and, it is from their employment in this way that their owners derive their income. The flocks are moved about from one holding to another wherever there is a demand for their services; a fixed rate, per night, being paid in grain for each 100 sheep, by the person on whose land the sheep are folded. In some cases, the flock owner is paid as much as 8 measures of grain per 100 sheep per night. The land when folded, is generally quite bare: no food is provided for the use of the sheep while, folded; during the day time they are allowed to graze in the adjacent country on whatever wild vegetation they may find, on road sides, and, on the marginal divisions of cultivated land. The mutton of this white-wool breed does not appear to be much esteemed in the District. When full grown, the carcass weight of one of these sheep is not more than 20 lbs.

Sheep kept as manure producers.

183. The flocks generally are composed of sheep of all ages and of both sexes. No attempt appears to be made to separate the sexes or, to select the breeding animals.

184. Government have made several efforts to improve the sheep stock of this District. As far back as 1839, 30 half-bred Merino rams were distributed amongst the influential Ryots and cattle-breeders but, the whole of the sheep appear to have died without producing any good result. In 1842, 20 half-bred and 2 pure-bred Merino rams were supplied to the District, and the Collector, Mr. Wroughton, kept them under his own charge instead of distributing them. These rams, he placed with a flock composed of 150 country ewes but, this experiment also appears to have failed. In 1850, 50 half-bred Merino rams were received in the District from the Mysore Sheep Farm; of these, 20 were given to respectable and well-to-do Ryots who, were thought likely to make a good use of the sheep; the remaining 30, were kept under the charge of the Collector. This experiment is also said to have failed; the failure was attributed to the delicate constitution of the sheep and to the want of care in their treatment.

185. The wool produced by the half-bred Merino sheep introduced into Coimbatore, appears to have been very much superior to anything yielded by the indigenous breeds of sheep. The only records available, on these experiments afford

little or nothing by the aid of which an opinion can be formed as to the real causes of the repeated failures, further than, that the sheep were subjected to a great deal of mismanagement.

186. A number of Mysore ewes, which had been exported to the Cape, produced with Merino rams there, a most excellent cross, the wool of which, commanded a very high price. And in Mysore, the Merino rams produced with the indigenous ewes very fair results.

THE RYOT.

Ryots.

187. The Cultivators occupying unirrigated land are generally very poor; the majority of them are deeply in debt. They attribute their poverty to a succession of bad seasons, and to their land having become less and less productive. I pointed out, at several of the Ryot gatherings that, though the produce of the land might now be much less than the produce obtained 20 years ago, the greatly increased value of that produce, far more than compensates the Cultivator for the diminished crops. They admitted, that there had been a great increase in the value of agricultural produce during the period in question, but contended, that this increase in the value of such produce was against the Cultivator rather than in his favor; because, of the largely increased demand for food in his family. On asking for an explanation regarding this statement, the people said that, their families now consisted generally of from 4 to 5 children, whereas, 20 years ago, 3 to 4 children was the average number in a family. They appear to look upon this larger demand for food in their families as a serious drawback to their prosperity for, instead of the higher prices tending to bring in a larger income, they tended only, to increase the cost of rearing a family. They attribute the larger number of their families to the reduced death-rate; many more children now surviving to reach adult years than was formerly the case.

188. They declared that, many of the holdings did not produce as much grain as would, after paying the Government rent, afford the Ryot and the members of his family two meals of food daily, throughout the year. They also asserted that the Cultivators possessed fewer live stock, and those of a much inferior kind, compared with what they formerly possessed; and that therefore their resources in a time of need were less than formerly: the sale of young cattle and sheep, having been the chief resource of Ryots in times when money was urgently required.

189. The usual rate of interest for money borrowed, varies from 18 to 24 per cent. Money is generally advanced to the Ryot on the security of the right-of-occupation of his holding. It is the general practice for the mortgagee after foreclosing a mortgage, to arrest, for any balance of principal and interest remaining unadjusted, after receiving the proceeds of the sale of the right mortgaged; this, I believe, is quite different to the practice followed in England. The right of the mortgagee after foreclosing and receiving the proceeds of the sale, to prosecute further, for any balance still standing in his favor, is a highly pernicious one. A man with a holding, the right of occupancy of which would be worth 500 Rupees, borrows

say 50 Rupees under the usual conditions, for some years he is probably not troubled about the payment of the interest, especially, if he has some well-to-do relatives, it is only when the interest and principal together, amount to about the selling value of the right-of-occupation that, the mortgagee begins to take active steps towards obtaining the settlement of his claim. If his claims are not then settled, he, puts up to auction the right-of-occupation to the holding, takes whatever sum is realized, and then, begins a system of persecution in order to obtain the balance. The unfortunate Cultivator who, by this time, has been turned out of his holding, and is compelled to look to field labor as a means of support, is threatened with arrest or, is arrested if he has friends likely to be able to assist him with money. Until the whole claim is paid off the unfortunate debtor may be arrested again and again.

190. The man who mortgages the right-of-occupation of a Ryot's holding is to all intents and purposes a Pawn-broker and, the transaction should be ruled by pawn-broking regulations. Under the arrangement now in force the policy of the mortgagee or pawn-broker, with whom the Ryot deals, is to keep perfectly quiet about the interest, until it with the principal, has amounted to a sum equal to the saleable value of the right pawned or mortgaged, when, the unfortunate debtor is entirely at the mercy of his creditor.

191. It would certainly be a great boon to the Ryot if all his borrowing transactions, were governed by the provisions of an Act somewhat similar to the Pawn-Broking Act of the United Kingdom. At any rate, there should be a limit to the period during which, the recovery of a debt of the sort, under reference, can be made; if the Statute of Limitation does include such transactions, the fact does not appear to be known to the Ryots for, I was informed of several instances in which, for periods of from 5 to 8 years, no interest had been paid and, in which, the mortgagee had enforced his claim for full interest and principal and, in one or two cases, had either arrested or threatened to arrest, for balances due after realizing, by foreclosing the mortgage.

THE LABORER.

Laborers.

192. At the last census there were 138,679 male laborers in Coimbatore, of whom, three-fourths were engaged in employments connected with land. Of these, a considerable number find employment during a portion of the year on the Coffee Estates in the Neilgherry District.

193. During the cultivating season, the agricultural laborer and such members of his family as are able to earn wages, generally meet with employment, but during the other half of the year they experience much difficulty and, have to fall back upon grass-cutting, fuel-collecting and similar casual employment.

Wages payed in kind.

194. It is usual, to pay wages in kind, money wages are only paid in and around the larger towns. When the agricultural laborer is engaged by the year, the usual wage is 40 Madras measures of grain;—cholum, cumboo, or, raggy; when so engaged payment

is only made, when work is actually performed, when sick and unable to work the laborer is not entitled to any allowance of grain. In some localities, the yearly laborer is paid 44 measures of grain per month, with an allowance of three Rupees in the year: in other localities the monthly wage is only 32 measures of grain without any other allowance. A boy, employed by the year, is paid 16 measures of grain per month, with an allowance of 12 annas in money, in the year. Yearly laborers generally receive from the Ryot on hiring, an advance of money varying from Rs. 10 to Rs. 20. The advance is made generally to enable the laborer to pay off the advance, he received from his former employer, whose service he could not leave without first paying off this advance. On entering first upon service, they receive from their employer an advance and this they are seldom able to repay without taking an advance from another person and thus rebinding themselves. It is the policy of the employers to discourage attempts on the part of laborers to repay advances. To all intents and purposes these laborers are serfs; for, their employers always manage to keep them in their debt. I made frequent enquiries regarding the circumstances of these laborers, the following case may be accepted as a fair illustration;—Veerasawmy is employed as a yearly cooly, under an agreement, he receives monthly 30 measures of grain; his wife, when employed for a whole month receives 15 measures of grain; his family consists of five children none of whom are able to work; when sick and unable to work his grain wage ceases; throughout the cropping season his wife works, on the average, 15 days in the month: he loses from sickness about one month in the year; he pays the rent of his hut, buys cloths with the grain he puts aside when both himself and wife meet with work; he experiences great difficulty in setting aside any grain for such purposes as, even when both are employed, the quantity received would not suffice to feed themselves and family.

195. The occasional laborer is paid a somewhat higher wage, however, he seldom gets employment out of the cultivating season. Two measures of grain is the usual allowance per day for a man of this class, and one measure per day for a woman. In some localities, the occasional laborer is paid only 1½ measures per day. When the occasional laborer cannot meet with agricultural employment, he goes to the jungles and cuts fuel which, he takes to the larger towns for sale, or seeks for work on the Coffee Estates in the Neilgherry District.

OFFICE-WORK.

196. The following are a few of the subjects on which advice and information was given, during the past year :—

Presidency, Province or District, from which advice or information was asked.	General nature of subject.
Travancore	Asking advice, regarding the treatment of growing paddy, severely attacked by insects.
Mysore	Asking advice, regarding the choice of a lift for raising water from a deep well.
Madras	Asking advice, regarding the management of a flock of sheep.
Neilgherries	Asking advice, regarding the selection of a chaff cutter for use where a large quantity of straw chaff is required daily.
Pondicherry	Asking for information, regarding the culture and curing of tobacco.
Ceylon	Asking advice, as to the means to be employed for improving native agriculture.
South Arcot	Asking advice, regarding the laying down of land under permanent grass.
England	Asking for information regarding the habits of the species of bamboo usually grown in Southern India.
Ganjam	Asking opinion regarding two kinds of indigo seed, from which, in the field, very different results were obtained.
Godavery	Asking for detailed information regarding the cultivation of Carolina paddy.
Travancore	Asking advice, regarding the reclamation, for agricultural purposes, of land frequently submerged by the sea.
N.-W. Provinces ...	Asking for information about water-lifts suited for general use in agriculture.
Wynaad	Asking advice regarding the treatment of certain sick cattle.
Madras	Asking opinion regarding the feeding of horses on Guinea-grass.
Malabar	Asking opinion regarding the manural value of the fern, that, grows so abundantly in Wynaad and Coorg.
Mysore	Asking advice about the general construction and size of loose boxes for cattle.
Neilgherries	Asking opinion, regarding the cultivation of Guinea-grass on land situated, at high elevations.
Jubbulpoor	Asking advice regarding the cultivation of tea and coffee.
Wynaad	Asking advice, regarding the cultivation of wheat.
N.-W. Provinces ...	Asking advice, as to the selection of a plough suited for general agricultural use.
Madras	Asking for information regarding the cultivation of coffee.
Calcutta	Asking for advice, as to the means to be taken for improving agriculture in Bengal.
Madras	Asking opinion regarding the feeding value of grâm, and, of a mixture composed of gram and maize, in equal proportions.
Malabar	Asking advice, regarding the treatment of land much infested with a grass, with long creeping roots.
Mysore	Asking advice regarding the choice of a set of agricultural implements and machines for an arable farm.
Travancore	Asking for advice regarding the culture and curing of tobacco.
Ganjam	Asking for information about wagons and carts, for carrying bulky loads over bad roads.
Tanjore	Asking for a list of agricultural books, likely to be of use to an intelligent agriculturist.
Neilgherries	Asking for information as to the description of crops likely to suit for general cultivation, on the Neilgherries.
Cuddapah	Asking advice as to the choice of a plough for turning over deeply the black cotton soil of the district.
Madras	Asking for information regarding the cultivation of tobacco.

Presidency, Province or District, from which advice or information was asked.	General nature of subject.
Kurnool	Asking for information regarding water-lifts suited for general agricultural use.
Neilgherries	Asking opinion whether cattle dung should be applied to the soil in the fresh state or, after having been decomposed.
Madras	Asking advice regarding the management of poultry.
Neilgherries	Asking opinion regarding the relative value of the manure of lean stock and of that of fattening stock.

197. I had during the past year, a large correspondence with the Board of Revenue; in addition to the letters on the ordinary business of the Department, I addressed the Board, on the following subjects;—

Prickly-pear—as a food for Farm Stock in times of scarcity.—Observations on—Board's Proceedings No. 1,289, dated 14th May 1875.

Madras Agricultural Exhibition.—Revised Prize List and Regulations for—submitted. Board's Proceedings, No. 1,344, dated 18th May 1875.

A Stock-breeding Farm.—Land for—. Report regarding efforts made to secure —and, proposals regarding utilization of Model Farm as—. Board's Proceedings, No. 1,524, dated 5th June 1875, and 2,919, dated 21st October 1875.

Jute Cultivation on the Sydapet Experimental Farm.—Report on—. Board's Proceedings, No. 1,714, dated 21st June 1875.

Carolina Paddy.—Supposed deterioration of—in India. Observations on—. Board's Proceedings, No. 1,895, dated 9th July 1875.

Hurriali Grass.—Culture of—. Memorandum on—. Board's Proceedings, No. 1,902, dated 9th July 1875.

Salt-soil.—Analysis of—. Report on—. Board's Proceedings, No. 3,016, dated 1st November 1875.

Maize and other seeds.—Distribution of—. Proposals submitted. Board's Proceedings, No. 189, dated 22nd January 1876.

Agricultural College.—Revised Prospectus for—submitted. Board's Proceedings, No. 942, dated 6th April 1876.

THE USE OF SALT IN AGRICULTURE.

198. The high price of salt in India is, a serious drawback to agriculture. In England, good agricultural salt for the use of stock, or, for use as manure, can generally be purchased at about 30 shillings per ton; similar salt costs, in this Presidency, about Rs. 50 per ton. Live stock cannot be maintained in good health unless, they have frequent and regular access to salt; but, it is rather as a condiment than as a food that, salt is so valuable. It, renders food more palatable, improves the appetite, increases the flow of saliva and, assists the digestive processes. Salt is peculiarly obnoxious to intestinal worms and, the preva-

Indian Farmers must pay three times as much as English Farmers for agricultural salt.

lence of these, and other internal parasites, in such numbers in the farm stock of this country is, to be accounted for, by the almost entire absence of salt in their diet.

As a manure.

199. Salt has long been used for promoting vegetation. It is of the greatest value as a manure in inland countries; land under the influences of sea breezes generally gets, by means of these breezes, sufficient salt for the requirements of agricultural crops; it has been ascertained by direct experiment that, the land near some coasts receives annually as much as 300lbs. of salt, per acre, carried to it by the winds. Salt is generally used as an auxiliary manure with lime or, other manures. In England, as much as 600lbs. of salt, per acre, is applied, with other manure, to land intended for Mangold Wurtzel; and, for meadow land a usual top-dressing is 200lbs. of salt with about 100lbs. of nitrate of soda. Heavy dressings of salt, are sometimes applied to pasture land to improve the herbage and, kill insects injurious to grass.

200. Salt, is also used, to prevent the too rapid decomposition of organic manure, a purpose for which, in this country, where putrefaction is so rapid, it is much needed; fold-yard manure when stacked in the field decomposes so rapidly, that in a space of four or five months the whole becomes a fine mould which, though valuable, does not serve the same purpose on the land as fold-yard manure in its natural state.

MANURE; AND, THE PRODUCTION OF GREEN FODDER CROPS.

201. We are frequently informed that, one reason for the wretched condition of agriculture in this country, is, the difficulty of obtaining manure. That, manure cannot be obtained without trouble, and that, its use puts the Ryot to some extra labor, I readily admit. Farming would of course, be a very much easier employment than it is, if all we had to do was, to plough and sow our land and, to harvest and sell our crops; but, in all long-settled countries, the Agriculturist must do a good deal more than this. Unfortunately, in this country, the more rapid is the increase of population, the more rapid is the decrease in the food-producing powers of our soils. As a general rule, the productiveness of Indian soils is yearly decreasing, while, in Europe under the influence of modern farming, the arable soils are yearly becoming more productive.

Indian soils becoming yearly less productive, European soils every year more productive.

202. It is, as much the duty of the Ryot to exert himself, in procuring manure for his soil as, it is his duty to plough and sow his land. A Ryot has no more right to expect a fair crop when he applies no manure to his dry land, than he would have had, to expect a good crop, from a sowing of seed scattered over unploughed land. The cost of the manure consists chiefly of expenditure on labor in collecting and bringing manure to the land and, this labor, most Cultivators can themselves perform.

The free use of manure essential to success in farming.

203. I cannot understand why in this country, the farmer should be allowed to do *exactly as he likes* with the land he rents from the State. The rent he pays is, supposed to bear a fixed relation to the crop he produces, which, of course, would be a very fair way of determining the rent, provided, *the land was fairly tilled.* If, the land is only half tilled and, starved as regards manure, the State's share of the produce will appear large, but, let the land be properly tilled and that share at once will bear but, a small proportion to the whole produce. Every Renter of State land should be compelled to use manure; if he does not use it, he is robbing the State for, he carries off far more than he is entitled to. What house-owner would be content with an ordinary rent, from a tenant who, besides availing himself of the usual privileges of tenancy used up in his fires as fuel the window frames, doors, rafters, beams and, other wood portions of the house, and yet, most of the Ryots are dealing quite as badly with the land rented by them from the State: not only are they taking out of the soil, what would be removed under a fair system of husbandry but, they are destroying the natural productiveness of the soil.

There should be some check or control over the farming of the Ryot.

204. It is true that, the permanent exhaustion of arable soil under the influences of cropping, is practically an impossibility; but, it certainly is the case that under injudicious cropping, the productiveness of a soil can speedily be brought down so low as to render the soil not worth cultivation, a state to which, a very large proportion of the arable soils of this Presidency have already sunk.

205. In most civilized countries, tenants are, generally bound to have a considerable area of their arable land annually under what are called restorative crops, such as turnips, green fodder, &c., which must be converted into manure on the farms where produced, by the agency of the live stock. If it is necessary in countries, where agriculture has reached a high state of perfection, to prescribe and enforce regulations for maintaining the fertility of the soil; surely, in this country where agriculture is in the hands of poor, ignorant, superstitious people, it is the duty of the State, to which the land belongs, to prescribe and enforce regulations for the maintenance of its fertility.

In civilized countries Agriculturists not allowed to do as they like with the soil.

206. We have, in this country, many fodder crops eminently suited for general cultivation: why not then, insist upon the Ryot devoting a certain proportion of his land annually to their culture? The proportion to the whole area, need be but small, a sufficient area only, to raise fodder for the working and milch cattle kept on the holding. In this way, a certain quantity of manure would be ensured, and the deteriorating influences, to which the land is now subjected, would, in some measure, be checked. We are told that the ryot cannot afford to grow fodder; my answer is, that he cannot afford to lose his cattle by starvation, or lose their full services, from weakness; and, *that the country cannot afford the cost of periodical famines.*

Compel the culture of fodder crops on all State land.

207. Of course, the cropping of 10 or, 15 per cent., of our arable land by fodder crops would not, altogether render the country independent in an unusually bad

season but, I am convinced that, if a fair proportion of farm yard manure, made by properly fed cattle, was applied regularly to our arable soils, their powers of absorbing and retaining moisture would be greatly increased ; and in this way, vast stores of moisture would be available where now, moisture is almost entirely absent.

208. The question is not whether it will pay the Ryot to grow fodder, any more than it is, whether it pays him to plough his land ; the one duty is, as necessary as the other. It is ridiculous to expect that, the Ryot will obtain a *direct*, return for the fodder he may grow ; the advantages derived from the consumption of a fodder crop on a farm, are never secured in a direct way, or, at once but, they influence for good the whole working of a farm, for years, in many indirect ways, which effects in their aggregate value, exceed the value of any ordinary grain crop, produced under the conditions, common in this country. Under the village system, there would be no difficulty whatever, in determining whether the prescribed area of land was annually cropped with fodder crops.

TOWN REFUSE AND THE PRODUCTION OF FUEL.

209. Nearly all the Municipalities in the plains of Southern India experience great difficulty in disposing of the refuse of their towns. No where in the plains, except to a very limited extent, has the Ryot been induced to cart away town refuse for use as manure. One reason for this is that, in none of these towns have any attempts been made to separate the valuable portions of the refuse, which alone, would bear the cost of cartage. Pieces of bricks, of pan-tiles, bottles, chatties, &c., and similar rubbish mixed with town refuse, greatly reduce its value for agricultural use.

210. I intend in the remarks that follow, only to refer to the heaps of rubbish, which now so frequently disfigure the outskirts of towns. These heaps, having in most instances existed for years, any noxious matter which they may originally have contained, will have become thoroughly decomposed and innoxious.

211. We cannot expect Municipal Corporations to engage directly in agriculture, they have so much to do in attending to the sanitary requirements of their towns ; but, I can see no reason why Municipal bodies should not be extensive holders of fuel plantations, in the working of which they could use up a great deal of the refuse of the town, especially that which has been stored in heaps for a long time.

212. Cheap fuel, is the *one great want of our towns.* At present, fuel is so costly it is utterly impossible to make use of steam machinery which, otherwise might be so usefully employed in raising water, for household use, for flushing drains, &c., &c. *At the present price of firewood in the city of Madras it would require 20 Rupees' worth of firewood to do the work in raising steam that, in England is done by 20 Shillings' worth of coals.* Even setting aside the benefit that would be experienced by the general public, from a reduction in the cost of fuel, the Municipal Corpora-

tions would, themselves, derive much benefit, in the reduced prices they would have to pay for bricks, tiles and lime, for, at present, the expense on account of fuel, *constitutes from* 40 *to* 50 *per cent. of the cost of these materials.* There are many other ways in which Municipalities would directly and indirectly derive benefit, from an abundant and cheap supply of fuel being made available.

Municipalities would be great gainers by having cheap fuel available for use.

213. A great deal might be done by raising fuel trees along the sides of our roads; under proper arrangements, with the aid of manure, a very large quantity of fuel might be produced in this way. If the roadside fuel trees were planted sufficiently close, felling might be begun when they were about one-half grown, every alternate tree being then cut down, and the spaces filled with young trees; in this way, uniformity would be preserved and, the roads would not be disfigured in appearance. The remainder of the first planted trees, might be cut down when matured, and, the spaces, they occupied, might be replanted. If the fuel trees were casuarinas, a crop would in this way be obtained every four or five years, which by the liberal aid of manure and water, there would be no difficulty whatever in securing.

214. Though, a very large quantity of town manure might thus be usefully employed in raising road-side trees, for use as fuel, there would still, in most towns, be a considerable quantity of manure for disposal.

Municipal Fuel Plantations.

215. Near many towns there is plenty of exhausted arable land available, one or more blocks of which conveniently situated, as regards roads, might be purchased, or hired, by the Municipal authorities. This land, after being heavily manured and, deeply ploughed, might be planted with fuel trees. If properly fenced, the expense of maintaining these plantations would not be great, after, the first two or three years. A dressing of manure, might annually be spread over the ground which, would promote the growth of the trees, and, with the leaves that fall, the indigenous vegetation that will spring up and die on the ground, the soil, after the removal of the trees would be rendered more valuable for agricultural purposes, or, for replanting with trees. Of course, these annual dressings of manure, should be from a compost heap, and not, the fresh night-soil of a town.

216. A number of fuel plantations, thus established, in connection with each Municipality, would tend to improve the climate of the neighbourhood; and, when properly situated, and managed, there should be nothing in these plantations to prove injurious to health.

FISH CULTURE.

217. No attention has been given in Southern India, to the artificial propagation of edible fish and, yet there are few countries in which there are such facilities and inducements. We possess vast areas of water in the shape of rivers, tanks and channels over which, Government already has direct control. It is estimated

in America that one acre of water, will produce in fish as much human food as two acres of land. From my experience in the preservation of the portion of the River Adyar which, belongs to the Sydapet Farm Estate, I believe that, under proper arrangements, there would be no difficulty in producing on the average, from 100 to 150 lbs. of fish annually, per acre of water; assuming, of course, that, there are proper facilities for rearing and breeding the fish; that, means are taken to prevent the destruction of spawn and, the young fish, and that, there is sufficient food available for the fish either naturally, or, supplied artificially. It is true that, during the hot season the majority of our rivers, tanks, &c., become dry; but, there would be no great difficulty in providing means for sustaining a large proportion of the fish during the dry season, in all rivers and tanks of any extent; as, in nearly all such there are holes or hollows in which, there is water throughout the year; which, when necessary might, be deepened and extended, and their margins planted around with shrubs and other vegetation, likely to grow in such situations, in view to protecting the fish affording them shelter, and supplying them with food.

218. There are some fine perennial rivers in this Presidency, which might, under proper management, be made to add very materially to the food resources of the country. It would be somewhat difficult at once to stock with new breeds of edible fish, any of these large rivers; but, much benefit would eventually result if, but the most suitable portions only, were stocked.

219. In England, France, America and Australia, Pisciculture is now attracting much attention. In these countries, some most important results have been achieved in re-stocking rivers which, by the neglect of ordinary precautions, had become almost destitute of edible fish.

THE SYDAPET EXPERIMENTAL FARM.

SEASON, &c.

1. The rainfall registered at this Farm, during the past year, was only 38·14 inches, and rain fell only on 54 days. The average annual fall in the ten previous years was 49·39 inches; and, the average annual number of wet days, during the same period, was 71·7. The following statement shows, the quantity of rain registered on each wet day during the year:—

Rainfall registered at the Experimental Farm during the year ending 31st March 1876.

April 1875.	May 1875.	June 1875.	July 1875.	August 1875.	September 1875.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1	1 ... 0·01	1	1 ... 2·31	1 ... ...
2	2	2	2	2	2 ... ...
3	3	3	3	3	3 ... ...
4	4	4	4	4 ... 0·64	4 ... 0·23
5	5	5	5	5 ... 0·87	5 ... ...
6	6	6	6 ... 0·25	6 ... 0·07	6 ... ...
7	7	7	7	7	7 ... ...
8	8	8	8 ... 0·35	8 ... 0·22	8 ... ...
9	9	9	9	9	9 ... ...
10	10	10	10	10	10 ... ...
11	11	11	11	11	11 ... ...
12	12	12	12	12 ... 2·50	12 ... ...
13	13	13	13	13 ... 0·61	13 ... 0·57
14	14	14 ... 0·15	14	14 ... 0·77	14 ... 0·46
15	15	15	15	15 ... 0·10	15 ... ...
16	16	16 ... 0·11	16	16	16 ... ...
17	17	17	17	17	17 ... ...
18	18	18	18	18	18 ... ...
19	19	19	19	19	19 ... ...
20	20	20	20	20	20 ... 2·76
21	21	21	21	21	21 ... ...
22	22	22 ... 0·05	22	22	22 ... ...
23	23	23	23	23	23 ... ...
24	24	24	24	24	24 ... ...
25	25	25	25	25 ... 0·55	25 ... ...
26	26	26	26	26	26 ... ...
27	27	27	27	27 ... 0·39	27 ... 0·19
28	28	28	28 ... 0·06	28 ... 0·11	28 ... ...
29	29	29	29	29	29 ... ...
30	30	30	30	30	30 ... ...
	31		31	31	
Total ... None.	Total ... None.	Total ... 0·32	Total ... 0·66	Total ... 9·14	Total ... 4·21

Rainfall registered at the Experimental Farm during the year ending 31st March 1876.

October 1875.		November 1875.		December 1875.		January 1876.		February 1876.		March 1876.	
	Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
1	...	1	...	1	...	1	...	1	...	1	...
2	...	2	...	2	...	2	...	2	...	2	...
3	...	3	...	3	...	3	...	3	...	3	...
4	...	4	...	4	0·24	4	...	4	...	4	...
5	...	5	...	5	...	5	...	5	...	5	...
6	1·61	6	...	6	1·66	6	...	6	...	6	...
7	...	7	...	7	0·34	7	...	7	...	7	...
8	...	8	...	8	0·10	8	...	8	...	8	...
9	0·23	9	0·27	9	...	9	...	9	...	9	...
10	...	10	1·65	10	...	10	...	10	...	10	...
11	0·66	11	0·36	11	0·10	11	...	11	...	11	...
12	0·02	12	0·08	12	...	12	...	12	...	12	...
13	...	13	1·00	13	...	13	...	13	...	13	...
14	...	14	7·00	14	0·28	14	...	14	...	14	...
15	...	15	...	15	...	15	...	15	...	15	...
16	0·43	16	...	16	0·27	16	...	16	...	16	...
17	...	17	0·03	17	...	17	...	17	...	17	...
18	0·04	18	0·10	18	...	18	...	18	...	18	...
19	0·07	19	0·21	19	...	19	...	19	...	19	...
20	1·18	20	...	20	...	20	...	20	...	20	...
21	0·62	21	1·85	21	...	21	...	21	...	21	...
22	0·18	22	...	22	...	22	...	22	...	22	...
23	0·18	23	2·97	23	...	23	...	23	...	23	...
24	...	24	...	24	...	24	...	24	...	24	...
25	...	25	...	25	...	25	...	25	...	25	...
26	...	26	...	26	...	26	...	26	...	26	...
27	...	27	...	27	...	27	...	27	...	27	...
28	...	28	...	28	...	28	...	28	...	28	...
29	0·08	29	...	29	...	29	...	29	...	29	...
30	...	30	...	30	...	30	...			30	...
31	...			31	...	31	...			31	...
Total ...	5·30	Total ...	15·52	Total ...	2·99	Total ...	None.	Total...	None.	Total	None.

2. In the next statement I show, the rainfall in each week of the year, compared with the average weekly rainfall in the previous ten years. I prefer this arrangement to that usually adopted, as it brings out more clearly the character of the seasons :—

Weeks.	1875-76.		Average of the previous ten years.		Weeks.	1875-76.		Average of the previous ten years.	
	Inches.	Wet days.	Inches.	Wet days.		Inches.	Wet days.	Inches.	Wet days.
1st Week ...	...	...	·22	·2	11th Week ...	0·26	2	1·20	2·2
2nd do. ...	...	...	·03	·2	12th do. ...	0·05	1	·32	1·5
3rd do. ...	...	...	·01	·1	13th do. ...	...	...	·57	2·1
4th do. ...	...	...	·01	·2	14th do. ...	0·25	1	·24	1·0
5th do. ...	...	...	1·34	·5	15th do. ...	0·35	1	1·40	2·4
6th do. ...	...	...	·08	·3	16th do. ...	...	...	·91	3·0
7th do. ...	...	...	·04	·2	17th do. ...	0·06	1	1·15	2·6
8th do. ...	...	...	·06	·4	18th do. ...	2·95	2	·67	1·6
9th do. ...	0·01	1	·01	·2	19th do. ...	1·16	3	1·60	2·9
10th do. ...	...	...	1·17	1·4	20th do. ...	3·98	4	·66	2·5

Weeks.	1875-76.		Average of the previous ten years.		Weeks.	1875-76.		Average of the previous ten years.	
	Inches.	Wet days.	Inches.	Wet days.		Inches.	Wet days.	Inches.	Wet days.
21st Week ...	0·55	1	1·40	2·0	38th Week ...	0·27	1	·36	·7
22nd do. ...	0·50	2	1·28	2·4	39th do. ...	...	...	·11	·9
23rd do. ...	0·23	1	1·00	2·3	40th do. ...	...	...	·01	·3
24th do. ...	1·03	2	1·15	2·0	41st do. ...	...	...	·01	·2
25th do. ...	2·76	1	1·58	2·4	42nd do. ...	...	...	·58	·6
26th do. ...	0·19	1	1·21	2·0	43rd do. ...	...	...	·49	·3
27th do. ...	1·61	1	1·46	2·1	44th do. ...	...	...	...	...
28th do. ...	0·91	3	·80	1·6	45th do. ...	...	...	·70	·6
29th do. ...	1·72	4	3·05	3·5	46th do. ...	...	...	·02	·1
30th do. ...	0·98	3	2·97	3·5	47th do. ...	...	...	·13	·1
31st do. ...	0·08	1	1·73	2·2	48th do. ...	...	...	·15	·2
32nd do. ...	1·92	2	2·17	2·4	49th do. ...	...	...	·08	·4
33rd do. ...	8·47	5	2·07	2·7	50th do. ...	...	...	...	...
34th do. ...	5·13	4	3·24	3·3	51st do. ...	...	...	...	...
35th do. ...	...	...	5·49	3·8	52nd do. ...	...	...	..	...
36th do. ...	2·34	4	3·34	1·9					
37th do. ...	0·38	2	1·12	1·7	Total ...	38·14	54	49·39	71·7

3. The following table shows, the rainfall in each month, compared with the average rainfall in the same months during the preceding ten years ;—

Months,	1875-76.		Average of the preceding 10 years.	
	Inches.	Wet days.	Inches.	Wet days.
April	...	...	0·26	0·7
May	...	...	1·52	1·5
June	0·32	4	3·26	7·3
July	0·66	3	4·29	9·7
August	9·14	12	4·82	10·5
September	4·21	5	5·23	9·1
October	5·30	12	9·00	11·7
November	15·52	11	13·22	12·6
December	2·99	7	5·66	5·8
January	...	...	1·07	1·4
February	...	...	0·91	0·9
March	...	...	0·15	0·5
Total ...	38·14	54	49·39	71·7

4. During the first four months of the year, the total rainfall amounted to, scarcely, one inch, and there were only seven days on which rain fell, hence, it was impossible to prepare the land for summer crops—cumboo, gingelly, &c.,—which, in this district, are usually sown during June and July. The fall of rain in August was very heavy, however, it was too late to be of any benefit to agriculture further than that it facilitated the preparation of the ground for the cold weather crops. The rainfall of September was unusually light, a large breadth of the land, sown in the early part of the month, had to be resown afterwards, as so many of the young seedlings perished from the effects of the drought and high temperature. The rainfall in October, also, was very light. In November there were several days on which the rain was very heavy ; the fall registered on the 14th, was equal to nearly one-fifth of the entire fall of the year ; in many localities crops, which had previously been suffering from drought, were much injured by floods. In December, there

were seven days on which rain fell, but as the total quantity amounted only to 2·99 inches, the crops, *which it must be remembered were a month later than usual*, suffered greatly. During the latter half of December and throughout the whole of January, February, and March, there was no rain.

AGRICULTURAL EDUCATION.

Abolition of Apprentice Classes.

5. In previous reports, I have frequently pointed out the great mistake made, in supposing, that the young men, who were in the Sydapet Apprentice Classes could, by mere field training, qualify themselves, as Agricultural Instructors, for employment in parts of the Presidency where the agricultural conditions differ from those met with at Sydapet. In my report for the year ending the 31st of March 1873, I stated " They (the apprentices) certainly learn to copy what they see done on the Sydapet Farms, and they will probably pick up during their apprenticeship enough information, to enable them to conduct successfully small farms, if the circumstances of these Farms are not unlike those of the farms at Sydapet; but, the lads trained under such a system, can never be usefully employed in the Districts, in spreading agricultural knowledge, or in conducting agricultural operations, except those of the simplest kind. * * * * * * * * Mere field training will never fit a man to go into a new district to aid in introducing amongst its cultivators a better agricultural practice, Such training must be supplemented by theoretical teaching in the class-room and in the lecture-room under a definite system which will test the progress made from month to month." Agreeing in these views, Government, sanctioned the abolition of these apprentice classes and, authorized instead the establishment of a School of Agriculture at Sydapet.

The School of Agriculture.

6. The new Institution, will begin work as soon as the necessary temporary accommodation is provided. The permanent buildings will afterwards be erected; they will consist of suitable Lecture-rooms, Class-rooms, &c., a Veterinary Hospital, a Chemical Laboratory, an Agricultural Museum, &c. The Farm will be managed in view to afford every facility for the practical education of the students. The Institution will be attached to the Educational Department, but will be under my direct management. The instruction will extend over three years and will embrace a thorough study of Agriculture and, of such portions of Chemistry, Geology, Zoology, Botany, and the Veterinary Art as bear on the theory and practice of Agriculture; Farm Book-keeping, Land Surveying, and Mensuration.

7. The following are the Lecturers and Masters :—

Lecturers.

William R. Robertson, M.R.A.C., Superintendent, Government Farms	Agriculture.
George Western, M.R.C.V.S., Veterinary Surgeon to the Body Guard of His Grace the Governor	Veterinary.

James Keess, M.D., &c., Professor of Anatomy, Madras Medical College	Zoology.
W. Hamilton, Assistant Professor of Chemistry, Madras Medical College	Chemistry.
R. Wilkins, F.R.C.S., Assistant Professor of Botany, Madras Medical College	Botany.
	Geology.
Charles Benson, M.R.A.C., Assistant Superintendent, Government Farms	Field Experiments and Practical Agriculture.

Masters.

A Ganapathy Iyer, F.A.	Arithmetic and Book-keeping.
T. V. Seetharam Moodelly	Land Surveying and Mensuration.

8. Candidates before admission, must have passed the University Matriculation Examination, the Uncovenanted Civil Service Examination or, the Entrance Examination of the Institution, which is as follows:—

English.—Ability to write correctly and legibly from dictation and express themselves with reasonable correctness and intelligence in a letter or in a report.

Arithmetic.—The first four simple and compound rules, vulgar and decimal fractions.

Vernacular.—Tamil or Telugu (in the case of Europeans and Eurasians only); ability to translate into English easy sentences from an elementary vernacular prose work commonly used in schools.

History.—The leading facts of the histories of India and England.

Geography.—The outline of geography generally, and the geography of India in particular.

9. Stipendiary studentships and scholarships are offered for competition at the end of the first session.

10. At the opening of the Institution accommodation will be provided for only about 35 students and for, about a dozen of the students of the Madras Normal School. It is intended to make agriculture a subject of study in the Middle-class and Elementary Rural Schools of this Presidency, and it is hoped that the young men who are studying at the Madras Normal School, in view to becoming School-masters will, during their attendance at the Agricultural lectures, obtain sufficient knowledge to enable them to teach elementary Agriculture in the schools with which they may afterwards be connected.

11. Europeans, Eurasians, and Natives of all classes are eligible for admission into the Institution, when vacancies exist, on complying with the following conditions.

12. Candidates who desire to avail themselves of stipendiary studentships or scholarships must be between sixteen and twenty-four years of age, and must produce, with their application for admission, the following certificates:—

(*a.*) Certificate of age.
(*b.*) Do. of character.
(*c.*) Do. of physical fitness.*

* Should state that the candidate has been vaccinated.

ESTATE IMPROVEMENTS.

Removal of the Wudder Settlement.

13. The Wudder Settlement referred to in paragraphs 18 to 21, in my report for 1873-74, was removed from the Farm during the past year. An allowance was given to each hut-owner to meet the cost of removing his hut ; the trees on the ground were valued and compensation was paid to the people who had raised them.

Land for Stock-breeding Experiment.

14. It has been found impossible to secure, at a reasonable cost, the land for a stock farm, referred to at paragraph 62 of my report for 1873-74. Though a large portion of the land is composed of naturally unproductive laterite soils, chiefly held under the "Tope Rules," the sum asked for the right of occupation of the 300 acres was Rupees 10,000, in addition to which, a deduction would have to be made in the quit-rent of the Adyar Zemindary, to which a portion of the land belongs. To fence the ground, make the necessary roads, level the broken surface quarried over in raising gravel, and to carry out other needful improvements, an expenditure of something like Rupees 10,000 would have to be incurred which would bring up the total outlay to Rupees 20,000, at the least. Under these circumstances, there was no choice but to abandon all intention of starting a stock farm, on the land in question, and, there being no other land in the neighbourhood then available, it was determined to utilize for the purpose the land, which, until lately, constituted the Model Farm. Fuel and fruit trees will be planted on the sandiest soils, under the influence of which, these soils will eventually be brought into a better state for cultivation; the other portions of this land, including the portion occasionally submerged when the river is in flood, will be planted with guinea-grass and other grasses, to be grazed by cattle and sheep. The Slaughter yards of the Commissariat Department, which are to be transferred to the Farm at a valuation, will be utilized as stock-yards, for which purpose, they are admirably suited.

TILE-YARD.

Tile-yard.

15. The Farm Tile-yard was fully employed during the past season ; a large number of drain pipes, bricks, and roofing tiles were made. The average cost for making 1,000 bricks of the following dimensions—length 9 inches, breadth $4\frac{1}{3}$ inches, and thickness $2\frac{3}{4}$ inches—was as below :—

	Rs.	A.	P.
Preparing the clay	0	8	0
Conveying the clay to the table	0	6	0
Making the bricks	0	6	0
Removing the bricks to the drying sheds	0	6	0
Cleaning and moving the bricks while drying	0	8	0
Labor at the kiln	0	7	0
Fuel	5	0	0
Add 25 per cent. for superintendence, wear and tear of plant, breakages, &c.	1	14	3
Total ...	9	7	3

16. The average cost for making 1,000 two-inch drain pipes was as below :—

	RS.	A.	P.
Preparing the clay ...	0	8	0
Removing the clay to the machine	0	3	0
Screening the clay ...	0	12	0
Making the pipes ..	1	0	0
Rolling the pipes ...	0	14	0
Labor at the kiln ...	0	8	0
Fuel ...	4	0	0
Add 25 per cent. for superintendence, wear and tear of plant, breakages, &c. ...	1	15	3
Total ...	9	12	3

17. The average cost for making four-inch drain pipes was about Rupees 15 per 1,000. All the pipes, both two-inch and four-inch, were 1 foot in length.

18. The following shows the cost of 1,000 flat tiles, each 10½ inches long, 7 inches broad, and half an inch thick :—

	RS.	A.	P.
Preparing the clay ...	0	6	0
Removing the clay to the shed ...	0	3	0
Making the tiles ...	0	10	0
Cleaning, moving, and drying the tiles ...	0	6	0
Labor at the kiln ...	0	8	0
Fuel ...	3	0	0
Add 25 per cent. for superintendence, wear and tear of plant, breakages, &c. ...	1	4	3
Total ...	6	5	3

19. The earth in the tile-yard is well suited for making drain pipes, but it is not so well adapted for making bricks.

BUILDINGS, &c.

20. All the sheds at the Experimental Farm, which were roofed with thatch, have been unroofed and tile-roofs have been substituted. I found the thatch-roofs much more costly, than tile-roofs, over a term of years. Even, when placed on brick-in-lime pillars and every precaution taken to keep out white-ants, rats, &c., I found, that thatch seldom lasted more than three years, and as, on the average, it cost 3 Rupees per square, this, in twenty years, would represent an expenditure of Rupees 20 per square of roofing—*more than twice the cost of tiles, which would last, at the least, twenty years.*

Substitution of Tile-roofs for Thatch-roofs.

21. The fact is, in Southern India, the best economy in putting up permanent buildings is to use *first class* materials, and to do the work well; the first cost will perhaps be great, but over a term of years buildings so constructed will prove much less expensive than those made of cheap materials. Long droughts, followed by periods in which the

Temporary erections costly.

atmosphere is saturated with moisture, attacks of white-ants, &c., prove most disastrous to cheaply put up erections. In the maintenance of such, an annual expenditure of from 20 to 25 per cent. on the first cost, is not at all unusual, which is, about three times the cost of the up-keep of buildings, sheds, &c., that have been built in a substantial manner. Agricultural produce is frequently seriously damaged, from the effects of bad weather, vermin, and other causes, when stored in these so-called cheap structures.

Quarters for the Assistant Superintendent.

22. A residence was built, last year, on the Farm for the Assistant Superintendent. The house is built throughout with brick-in-lime. The wood work is teakwood and benteak. The house contains three large rooms and four small rooms; the large rooms are each about 24 feet long and 16 feet wide. The height of the walls to the wall plate is 11 feet. There is a verandah 8 feet wide at the back and front of the house. The out-buildings consist of coach-house, stable, and kitchens. The total cost was Rupees 4,431-10-7, which, at 10 per cent., represents a monthly rent of Rupees 37, a moderate rent for the accommodation afforded.

A new Barn.

23. A Barn has been erected with the materials of the old engine sheds; these sheds were no longer needed for the purpose for which they were built, and as they were situated within the flood level of the river, they were of but little use. A bullock-power has been erected near the Barn, and it drives a cotton gin, a chaff cutter, a thrashing machine &c.; accommodation is also afforded in the Barn for storing maize cobs, grain in the straw, cotton in the seed, &c., while undergoing preparation for the granary.

Walls made of brick laid in mud are not durable when exposed to the weather.

24. The walls of most of the buildings on the Farm are made of brick laid in mud; they are plastered in the inner side, and the outer side is pointed with lime. In the first cost, such walls are much cheaper than those built with lime, but it is, I think, a mistake to erect buildings of a permanent kind, in such a way. Plastering the outside, preserves such walls, but this, adds materially to their cost. In building with mud, one volume of mud is generally used for about two volumes of brick; it will therefore, be readily understood that, as the mud must expand and contract with every change in the weather, such walls must inevitably crack. In this country, the walls of buildings are frequently exposed alternately, to a deluge of rain, and, to a dry burning atmosphere. Plastering the outer walls of a building does not improve its appearance, but, I fear, there is no choice but to adopt this course when, the bricks are laid in mud.

25. We have made some excellent division walls, for cattle sheds, with 4-inch pipes laid in concrete; such walls, provide for complete ventilation, but they are not adapted for situations in which they will be exposed to rough usage.

Concrete.

26. We find that concrete is admirably suited for making water channels, and, arches over drains; the material is much cheaper than "bricks laid in lime," while it can be worked and laid by ordinary field hands whose labor is, of course, much cheaper than the labor of bricklayers.

LAND IMPROVEMENTS.

27. The surface of a considerable area of the undulating sandy land was levelled to a slope of about 1 foot in 200 feet. On these soils the tillages performed and the manure applied during the past three or four years, had produced but little appreciable benefit. I had, at first, hoped that it would be only necessary to roughly level the surface of such land, but I now see that, we would have gained largely, had we, on first commencing to cultivate these soils, levelled their surface as we have now done.

Chembrumbaukum Channel.

28. The channel, by which it is intended that the Experimental Farm shall obtain water from the Chembrumbaukum Tank, was begun last year, but it is not yet finished. I fear, however, that it will not fulfil the object for which it is intended. It will, I understand, be nearly ten miles in length, and will be merely a dug trench of about 1 foot deep by 1 foot wide. This trench, will skirt a public road for some miles, and will be kept open only with great difficulty and, at much expense.

Sub-soil drained land.

29. The pipes of the land sub-soil drained, continue to work satisfactorily, as far as can be ascertained. During a recent heavy fall of rain, the main pipe was discharging a volume of water nearly equal to its full capacity. It was thought that pipe sub-soil drains would not answer in this country as, white-ants would close them up, however, so far, they do not appear to have done so. The land drained is in a very healthy state, and is greatly more productive and much easier to work, than before being drained.

30. Two nurseries have been established for raising trees, for planting out over the estate. During the last hot season, when, of course, the difficulty of transplanting trees successfully was great, we planted out a number of trees, and, by placing in the soil near each tree a drain pipe, vertically, through which water could be poured into the sub-soil, obtained most satisfactory results. The usual custom when watering, in this country, is to flood the ground around the stem of the tree, in this way forming a basin with a close impervious flooring, through which but very little water can pass, the bulk being evaporated into the atmosphere. When a drain pipe is placed vertically, about a foot into the ground, it enables the water to pass down direct into the sub-soil to the roots of the plant.

LIVE STOCK.

Aden Stock.

31. The imported Aden stock continue to thrive; the cow has had a bull calf by the imported bull, and it promises to be a superior animal; we are now in possession of four pure-bred Aden bulls, which will suffice for the purposes of the experiment.

32. The cows sent to the bulls at the Farm are, generally, very inferior and in poor condition. Native cultivators object to incur any expense when grass is scarce for providing special food for their milch cattle; they argue that, the bullocks pay for their food, in the work they perform, but that, the cow yields milk in such small quantities and over so short a period that, she will not, in her milk, repay the

cost of any special feeding. But there is no good reason why, the cows of this country should not earn their food, by working, at any rate, during the time they are not giving milk. In many parts of Europe, cows are very extensively employed as draught animals. During a month or two before calving and, for three or four months afterwards, it might be inexpedient to work cows, but during six months in the year, they might, as draught animals, earn their food.

Cows as draught animals.

DAIRY CATTLE.

33. In my last annual report at pages 16, 17, 18, and 19, I recorded, in detail, the amount of milk yielded daily by a cow, the daughter of a Nellore cow by a Devon bull. These records, extended only up to six months after calving; the details that follow, show the quantity of milk yielded daily, by the cow, during the entire milking period:—

——	Morning.	Evening.	Total.		——	Morning.	Evening.	Total.	
	MRS. OLKS.	MRS. OLKS.	MRS. OLKS.	PINT.		MRS. OLKS.	MRS. OLKS.	MRS. OLKS.	PINT.
169th day...	2 0	1 6	3 6		211th day ...	2 0	1 5	3 5	
170th „ ...	2 0	1 5	3 5		212th „ ...	2 1	1 4	3 5	
171st „ ...	2 0	1 5	3 5		213th „ ...	2 0	1 3½	3 3½	
172nd „ ...	2 0	1 5	3 5		214th „ ...	2 0	1 4	3 4	
173rd „ ...	2 0	1 5	3 5		215th „ ...	1 7½	1 5	3 4½	
174th „ ...	2 0	1 4	3 4		216th „ ...	1 7½	1 4	3 3½	
175th „ ...	2 0	1 5	3 5		217th „ ...	1 7¼	1 6	3 5¼	
25th week.	14 0	11 3	25 3	76	31st week.	13 7¼	10 7½	24 6¾	75
176th day...	2 0	1 4	3 4		218th day...	1 7½	1 5½	3 5	
177th „ ...	2 0	1 4	3 4		219th „ ...	1 7½	1 6	3 5½	
178th „ ...	2 0	1 5	3 5		220th „ ...	1 7	1 6	3 5	
179th „ ...	2 0	1 6	3 6		221st „ ...	1 7	1 7	3 6	
180th „ ...	2 0	1 6	3 6		222nd „ ...	1 7	1 6	3 5	
181st „ ...	2 3	1 4½	3 7½		223rd „ ...	1 7	1 6	3 5	
182nd „ ...	2 2½	1 5	3 7½		224th „ ...	1 6½	1 6¼	3 4¾	
26th week.	14 5½	11 2½	26 0	78	32nd week.	13 1½	12 2¾	25 4¼	77
183rd day...	2 2½	1 5½	4 0		225th day...	1 6¾	1 4	3 2¾	
184th „ ...	2 0	1 5	3 5		226th „ ...	1 7	1 4	3 3	
185th „ ...	2 3	1 5¼	4 ¼		227th „ ...	1 7	1 4¼	3 3¼	
186th „ ...	2 2½	1 5	3 7½		228th „ ...	1 4	1 2½	2 6½	
187th „ ...	2 0	1 4½	3 4½		229th „ ...	1 2	1 3	2 5	
188th „ ...	1 7½	1 4½	3 4		230th „ ...	1 6	1 4	3 2	
189th „ ...	1 7	1 4¼	3 3¼		231st „ ...	1 6	1 4	3 2	
27th week.	14 6½	11 2	26 ½	78	33rd week.	11 6¾	10 1¾	22 ½	66
190th day...	1 7½	1 5	3 4½		232nd day...	1 7	1 4	3 3	
191st „ ...	2 1	1 4½	3 5½		233rd „ ...	1 5½	1 4¼	3 1¾	
192nd „ ...	2 2	1 5	3 7		234th „ ...	1 6	1 4	3 2	
193rd „ ...	2 1	1 4½	3 5½		235th „ ...	1 5½	1 3½	3 1	
194th „ ...	2 2	1 4¼	3 6¼		236th „ ...	1 4	1 3	2 7	
195th „ ...	2 2½	1 5	3 7½		237th „ ...	1 5	1 2½	2 7½	
196th „ ...	2 2	1 4	3 6		238th „ ...	1 5	1 3	3 0	
28th week.	15 2	11 ¼	26 2¼	79	34th week.	11 6	10 ¼	21 6¼	65
197th day...	2 2¼	1 5	3 7¼		239th day...	1 5	1 2½	2 7½	
198th „ ...	2 2	1 5	3 7		240th „ ...	1 4½	1 2½	2 7	
199th „ ...	2 2	1 4½	3 6½		241st „ ...	1 4	1 3	2 7	
200th „ ...	2 3	1 6	4 1		242nd „ ...	1 6	1 3	3 1	
201st „ ...	2 1	1 5	3 6		243rd „ ...	1 5	1 0	2 5	
202nd „ ...	2 1½	1 6	3 7½		244th „ ...	1 5	1 2	2 7	
203rd „ ...	2 3	1 5	4 0		245th „ ...	1 4	1 2	2 6	
29th week.	15 6¾	11 4½	27 3¼	82	35th week.	11 1½	8 7	20 ½	60
204th day...	2 2	1 6	4 0		246th day...	1 5	1 2	2 7	
205th „ ...	2 ½	1 7	3 7½		247th „ ...	1 5½	1 2	2 7½	
206th „ ...	1 7	1 6	3 5		248th „ ...	1 4	1 2½	2 6½	
207th „ ...	2 ¾	1 6	3 6¾		249th „ ...	1 4	1 2	2 6	
208th „ ...	2 0	1 6	3 6		250th „ ...	1 4	1 2½	2 6½	
209th „ ...	2 0	1 4	3 4		251st „ ...	1 4½	1 2	2 6½	
210th „ ...	2 0	1 6	3 6		252nd „ ...	1 4	1 2	2 6	
30th week.	14 2¼	12 1	26 3¼	79	36th week.	10 7	8 7	19 6	59

——	Morning.		Evening.		Total.			——	Morning.		Evening.		Total.		
	MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINT.		MRS.	OLKS.	MRS.	OLKS.	MRS.	OLKS.	PINT.
253rd day...	1	4¼	1	2¼	2	6½		281st day ...	0	7	0	6	1	5	
254th „ ...	1	3½	1	0	2	3½		282nd „ ...	1	0	0	1	1	1	
255th „ ...	1	3½	1	2	2	5½		283rd „ ...	1	3	0	6	2	1	
256th „ ...	1	4	1	2	2	6		284th „ ...	1	0	0	6	1	6	
257th „ ...	1	4	1	2	2	6		285th „ ...	0	7	0	¼	0	7¼	
258th „ ...	1	3	1	1	2	4		286th „ ...	1	4	0	¼	1	4¼	
259th „ ...	1	3	1	1	2	4		287th „ ...	1	0	0	¼	1	¼	
37th week.	10	1¼	8	2¼	18	3½	55	41st week.	7	5	2	3¾	10	¾	30
260th day...	1	3	1	0	2	3		288th day...	0	3	1	1	1	4	
261st „ ...	1	3	1	0	2	3		289th „ ...	0	2½	0	5½	1	0	
262nd „ ...	1	2½	1	½	2	3		290th „ ...	0	4	0	3½	0	7½	
263rd „ ...	1	3	1	0	2	3		291st „ ...	0	5½	0	¾	0	6¼	
264th „ ...	1	2	1	0	2	2		292nd „ ...	0	5½	0	½	0	6	
265th „ ...	1	2½	1	0	2	2½		293rd „ ...	0	6	0	½	0	6½	
266th „ ...	1	2	1	0	2	2		294th „ ...	0	5	0	½	0	5½	
38th week.	9	2	7	½	16	2½	49	42nd week.	3	7½	2	4¼	6	3¾	19
267th day...	1	1½	0	7	2	½		295th day...	0	3½	0	2	0	5½	
268th „ ...	1	2	1	0	2	2		296th „ ...	0	4	0	1	0	5	
269th „ ...	1	2	0	7	2	1		297th „ ...	0	4	0	2	0	6	
270th „ ...	1	0	0	7	1	7		298th „ ...	0	4	0	2½	0	6½	
271st „ ...	1	1	0	7	2	0		299th „ ...	0	3½	0	1½	0	5	
272nd „ ...	1	0	0	7	1	7		300th „ ...	0	4	0	½	0	4½	
273rd „ ...	1	1	0	7	2	0		301st „ ...	0	4	0	½	0	4½	
39th week.	7	7½	6	2	14	1½	43	43rd week.	3	3	1	2	4	5	14
274th day...	1	0	0	7	1	7		302nd day...	0	2½	0	½	0	3	
275th „ ...	1	0	0	7	1	7		303rd „ ...	0	2	0	½	0	2½	
276th „ ...	1	0	0	7	1	7		304th „ ...	0	3½	0	½	0	4	
277th „ ...	1	0	0	7	1	7		305th „ ...	0	3¼	0	¾	0	4	
278th „ ...	1	0	0	7	1	7		306th „ ...	0	3	0	½	0	3½	
279th „ ...	1	0	0	6	1	6		307th „ ...	0	2½	0	½	0	3	
280th „ ...	1	0	0	6	1	6		308th „ ...	0	2	0	1	0	3	
40th week.	7	0	5	7	12	7	39	44th week.	2	2¾	0	4¼	2	7	9

34. This cow, calved on the 6th of February, just about two months after she ceased to give milk. Thus, in the period between her third and her fourth calf, she yielded milk during 44 weeks and, was dry during 8 weeks.

Milk yielded during a milking period.

35. Having now obtained records of a complete milking period, we can readily calculate the cost of the milk produced. The total quantity of milk yielded was 1,177 measures and 1½ ollocks or, 3,532 imperial pints. The prices paid for the food of the cow and calf, &c., were similar to those that were paid during the first six months of the experiment, as recorded in paragraph 67 of my last report. The expenditure was as below :—

	RS.	A.	P.
365 days green fodder, 40 lbs. daily, at 300 lbs. per Rupee ...	48	10	8
365 days ground-nut cake, 4 lbs. daily, at 65 lbs. per Rupee ...	22	7	4
365 days bran, 2 lbs. daily, at 32 lbs. per Rupee	22	13	0
Salt, and bedding straw	12	0	0
Attendance	36	0	0
	141	15	0

The total expense thus amounted to Rupees 141-15-0; but, from this must be deducted the sum, Rupees 25, realized by the sale of the calf, leaving Rupees 116-15-0, as the cost of 1,177 measures of milk, equal to one Anna and seven Pies per measure, *which is, about 50 per cent. lower than the price at which milk, of very inferior quality, usually sells for, in the larger towns of Southern India.*

Cost of milk produced:

36. A yield of 441 gallons of milk in the year, is very satisfactory, considering the conditions met with in this country. In Ireland, a cow of the Kerry breed, which is the favorite dairy breed in that country, will yield during the year from 450 to 500 gallons of milk. Mr. John Haxton in his book "How to Choose a good Milch Cow" says "Mr. Crosby's dairy of Kerry cows at Ardfort Abbey, near Tralee, averaged 42 in number during the seven years ending with 1861, and averaged 488 gallons of milk a-piece, per annum, during that time, varying from 411 gallons in 1851 to as much as 542 gallons in 1856," and Mr. Morton in his "Hand-book of Dairy Husbandry" says "from these instances, it may be safely gathered that the average yield of well-managed cows varies from 480 to 600 gallons of milk a year, according to breed and size, the Kerry under good management yielding the former quantity, and the Yorkshire, short-horned, and cross breeds the latter."

37. The quality of the milk was, throughout the whole period, exceedingly good, yielding by volume, on the average, from 11 to 15 per cent. of cream.

Quality of milk.

38. A daughter of the cow, last referred to, by a Nellore bull, calved when about three years old. The following registrations show her yield of milk, per week, during her milking period:—

	MRS.	OLKS.	PINTS.		MRS.	OLKS.	PINTS.
1st week	22	1¼	66	25th week	29	7	90
2nd „	30	½	90	26th „	29	1	87
3rd „	29	2¾	88	27th „	29	5	89
4th „	29	3¼	88	28th „	27	3	82
5th „	29	2¼	88	29th „	27	6½	83
6th „	28	4¾	86	30th „	26	5	80
7th „	28	4½	86	31st „	25	4½	77
8th „	28	3	85	32nd „	22	6¼	68
9th „	27	3½	82	33rd „	20	2	61
10th „	27	1½	82	34th „	17	7	54
11th „	26	5½	80	35th „	16	5½	50
12th „	25	½	75	36th „	16	0	48
13th „	28	¼	84	37th „	14	6	44
14th „	26	5	80	38th „	14	1	42
15th „	27	7¾	84	39th „	13	2	40
16th „	28	6¾	87	40th „	14	3½	43
17th „	27	6	83	41st „	13	4	41
18th „	28	2½	85	42nd „	10	7¾	33
19th „	28	5¼	86	43rd „	7	7¾	24
20th „	27	7½	84	44th „	8	0	24
21st „	27	6½	83	45th „	8	6½	26
22nd „	28	3¼	85	46th „	7	2	22
23rd „	29	3	88	47th „	6	1¾	19
24th „	29	7½	90	48th „	5	3½	16

39. Considering the age of the cow, the yield of milk was very satisfactory. This cow had her first calf on the 13th of August when, as before noticed, she

was only three years old. She was milked during nearly 48 weeks, and had her second calf, on the 11th of August following, or scarcely twelve months after the birth of her first calf; thus, *she had had two calves when just four years old.*

Early maturity.

40. I would particularly draw attention to the foregoing facts as, they show how much good, can be effected by using bulls of a superior breed and, by providing suitable fodder and other food in sufficient quantity for the cows throughout the year. As a general rule, *the cows of this country seldom have their first calf until they are five or six years old.*

41. The dairy qualifications of the cows experimented with, I attribute chiefly to the Devon blood, and I am now convinced that it is to the dairy breeds of Europe that, we must look, for the means of effecting improvement in the milch cattle of this country.

42. The ordinary cow of the ryot, when in full milk, seldom gives more than one measure of milk per day, and these cows seldom yield milk for a longer period than six or seven months. As milk, in various forms, occupies an important place in the food of the people of this country, it is highly desirable that steps should be taken to improve the dairy stock.

Milk yielded by country cows.

43. As to the supposed weakened constitution of cattle, the produce of a cross between a bull of an European breed and a cow of an indigenous breed, all I can say is that, the cows, above referred to, have been under my personal notice for nearly four years, during which period they have had no illness whatever. They are generally out of doors all day and, find shelter under trees when the sun is very hot. In the neighbourhood of Madras cows, showing a good deal of the European cross, may be seen out of doors at all hours of the day.

44. I am very strongly of the opinion that bulls of the best dairy breeds of Europe, should be imported by Government, those of Southern Europe direct, and those of Northern Europe from Australia. Some moderately good bulls are now occasionally imported, but, from the small encouragement the importers receive, there is not much prospect of anything important being effected by these means.

Must import bulls of improved dairy breeds.

45. If private agriculturists in Australia, find it worth while, to send agents to England to purchase choice cattle of the best breeds and, ship them on such a lengthy and risky voyage, as that from England to Australia, it is not too much to expect that a Government presiding over a population of 30 millions of people, of whom two-thirds are agricultural, and, possessing a direct annual revenue from agriculture of between three and four millions pounds sterling, should expend a few hundred pounds annually, in introducing bulls of superior dairy breeds, into the country under their jurisdiction.

46. Something is about to be attempted on a small scale, in connection with the Sydapet Experimental Farm, towards effecting some improvement in the dairy stock of this country. The area of land set apart for the purpose is small, but it will suffice for the early requirements of the experiment.

Stock-breeding experiment.

SHEEP.

Chinese sheep.

47. The experiment made with sheep imported from China has proved that, the heat of this climate is too great for the sheep of this breed even when every care is taken to keep them from direct exposure to the heat of the sun. It is, I think, unnecessary to make any further trials with Chinese sheep; the breed, is clearly unfitted for immediate introduction into a hot climate.

Sydapet sheep.

48. The experiment being made with the Sydapet breed of sheep is proceeding as satisfactorily as could be wished. There are now at the Farm some excellent sheep of this breed, and what is equally as satisfactory is, that the sheep are perfectly hardy and quite fitted for the hottest climates. Though, as the experiment proceeds, the quality of the sheep will gradually improve and the good points which characterize the breed will become gradually more fixed, a good many years must yet elapse before the breed becomes thoroughly established. In view to the saving of time, it would, I think, be well to procure from Northern Australia, or Southern Europe, a few rams of a short-woolled breed, in order that an experiment may be made with the rams and a few of the ewes of the Sydapet breed, to determine whether the stages of improvement can be hastened.

POULTRY.

Australian poultry.

49. A number of Brahma-dorking fowls and Aylesbury ducks were imported from Australia. The fowls were inferior to those previously received from that country.

Pekin ducks.

50. The Pekin ducks referred to in paragraph 83 of my last report reached Madras in excellent health: the breed is the finest I ever saw, the birds being more like small geese than ducks. These ducks have been perfectly healthy since they arrived at the Farm; they are very prolific layers, and their eggs are large, some weighing as much as three ounces.

51. A large number of eggs of the imported fowls and ducks, have been sent to different parts of the Presidency, for setting:—

	No.
Brahma-dorking eggs	315
Aylesbury and Pekin duck eggs	402

The average-sized eggs, weighed as below:—

	Weight.	Average weight per Egg.
	ozs.	ozs.
7 Pekin duck eggs	19·03	2·71
5 Aylesbury duck eggs	9·74	1·94
8 Brahma-dorking fowls' eggs ...	13·73	1·71

SPROUTED GRAIN AND PULSE, AS FOOD FOR FARM-STOCK.

52. In a former report, I recommended that in preparing horse-gram as food for cattle, it would be much better, in every way, to steep the pulse in cold water, instead of boiling it. But, "sprouting," is now recommended, as being superior to either "boiling" or "steeping."

53. In England, farmers have long recognized the high feeding value of sprouted grain; but, it is only since the recent alteration in the Excise Laws that, they have been able to make use of it to any extent. Sprouted grain is, grain in a half-malted condition; in malting, germination is encouraged up to a certain stage; when this is reached, the germinating process is suddenly stopped; this is done by exposing the grain to a high temperature in a kiln. During germination, certain chemical changes take place in the seed which, render it more palatable to stock and, more easily digested and assimilated.

54. The grains and pulses of this country have, I find, very different capabilities for absorbing water; the following are the results of some experiments made:—

2 measures of maize placed in a vessel with 2 measures of water absorbed in 14 hours 1 measure of water.

2 measures of horse-gram placed in a vessel with 3 measures of water absorbed in 14 hours 2⅓ measures of water.

2 measures of paddy placed in a vessel with 2 measures of water absorbed in 14 hours ½ a measure of water.

2 measures of cumboo placed in a vessel with 2 measures of water absorbed in 14 hours ½ a measure of water.

55. The steeped grains and pulse, used in these experiments, after being removed from the water, were laid in thin layers and covered over from the light; when examined, 34 hours after, the paddy, horse-gram, and the cumboo were found to be sufficiently germinated for use. For these, it would appear that 43 hours was sufficient for the steeping and germinating process; maize, required some hours longer; but, of course, the length of time needed, depends, greatly, on the condition and age of the seed and, the temperature of the air at the time.

56. Germination should not be allowed to be continued too far. By exposing the sprouted grain, or pulse, to artificial heat, or, to a hot sun, further germination can readily be checked. Sprouted grain, or pulse, would, I think, be particularly suited for young horses that are in the habit of bolting their food only half masticated, as, the sprout will ensure a certain amount of mastication. The sprouting of pulses and grains is, I fear, attended with too much trouble, for the practice to become general, in this country.

PRICKLY-PEAR, AS FOOD FOR STOCK, IN TIMES OF SCARCITY.

57. A small experiment was recently made to ascertain the cost at which the thorns of the prickly-pear could be removed, in order to fit the plant for use in feeding stock. The average result of the trials made, was 120 pounds of prepared fodder, for each Rupee expended on labor. If the coolies had had more experience, there would, I think, have been no difficulty in preparing the fodder at a cost of about 10 Rupees per ton.

Cost of preparing the fodder.

58. Mr. Thomas, the Collector of Tanjore, has frequently directed attention to the importance of utilizing the prickly-pear, as a food for stock when, other food is scarce. I thoroughly agree with that gentleman in thinking, that the prickly-pear ought to be so used, under such circumstances. Of course, I do not recommend the prickly-pear as, being worth the notice of farmers as, a stock food, under *ordinary* circumstances, for, good fodders can so readily be produced, at much less cost.

59. If the thorns could be removed or, crushed by a machine, the cost of the fodder would be very trifling, but it would be difficult to do this by a machine; perhaps something could be effected by passing the plant between rollers, but I fear that the thorns, instead of being crushed, would be simply forced into the fleshy leaf; however, the matter is worth investigation.

Stock will not eat the fodder when first offered.

60. At the Experimental Farm, the prickly-pear, after preparation, was offered to pigs, sheep, and cattle, which all refused it, but I do not attach much importance to this, as domestic stock are generally very conservative in their tastes, frequently refusing food when offered for the first time, of which, afterwards, they perhaps become very fond.

SOILS.

SALT LAND.

61. In my last annual report I referred, briefly, to a small plot, the soil of which had been rendered barren, by an excess of soluble salts. Since then, samples of the soil have been subjected to chemical examination, by Mr. Schiffmayer; the following are the results:—

SOLUBLE SALTS IN THE SOIL.

		Per cent.
Soluble salts in the soil		3·226
Composition of the above—		
Sulphuric acid	(SO_4)	34·16
Silicic acid	($Si O_4$)	4·37
Chlorine	(Cl)	20·74
Potassium Sodium	(K) (Na)	30·99
Calcium	(Ca)	2·65
Magnesium	(Mg)	2·80
Ferric oxide	($Fe_2 O_3$)	1·50
Aluminum	(Al)	Trace
		97·21

62. The following shows the composition of the soluble portion of the efflorescence, which was collected, off the surface of the soil during the hot season:—

		Per cent.
Sulphuric acid	(SO_4)	39·60
Silicic acid	($Si O_2$)	0·54
Chlorine	(Cl)	20·30
Potassium	(K)	13·09
Sodium	(Na)	17·48
Calcium	(Ca)	2·59
Magnesium	(Mg)	5·20
Ferric oxide	($Fe_2 O_3$)	0·54
Aluminum	(Al)	Trace.
		99·34

63. The land, from which these samples of soil were taken, forms a part of the bed of the River Adyar, but is covered by the river only about two weeks during the whole year. Being situated only about 18 inches above the ordinary level of the river, and being surrounded on two sides by a channel connected with the river, the land cannot be sub-soil drained except at a cost out of all proportion to its value. The soil is formed of alluvial silt and the decomposed remains of many successive generations of aquatic plants that have grown and died upon it.

64. It will be observed that the soil was found to contain more than 3 per cent. of *soluble* salts, which fact, I think, explains conclusively why the soil is barren, it being well known that a soil which contains more than half a per cent of salts, capable of being washed out by water, cannot possibly be productive, even though it may be rich in the elements of plant food. Hence, we see how important it is that we should know something more of a soil than can be learned from its analysis before, venturing to offer an opinion regarding its fertility. An excess of soluble salt, even of a salt that may possess considerable value, as a manural agent, will cause barrenness instead of fertility.

An excess of soluble salt ruins a soil.

An analysis alone not sufficient for determining fertility of a soil.

65. The land, from which the samples of soil were taken, might be improved, temporarily, by being heavily manured with fold yard manure and, by being deeply ploughed; but, these influences would operate only for a short time, and would need to be repeated again and again, in order to keep the soil in a condition fit for the growth of crops.

66. There is a considerable area of arable land, in this Presidency and, in other parts of India, which has become sterile, apparently from an excess of soluble salts, judging from the periodical appearance on it of an efflorescence during the hot season. An investigation to ascertain the percentage of soluble salts contained in these soils, near their surface, and at a depth of 8 or 10 inches, should be undertaken; it might afford valuable information in indicating which of the soils would be most likely to be ameliorated under the influence of deeper tillage. For example, the surface soil, to a depth of three or four inches, might contain say, one per cent. of soluble salts which, of course, would render the soil unproductive if tilled only to a depth

Large area of land rendered unfertile by salt.

Some salt soil can be improved by deeper tillage.

of three or four inches; but, *if* analysis proved that the strata of soil immediately beneath contained say only a $\frac{1}{4}$ per cent. of soluble salts, it is easy to see, that, to improve the surface soil, it would only be necessary to plough deeply into the lower soil, and, mix it with the upper layer.

BLACK COTTON SOILS.

67. In a letter, No. 532, of the 14th of October last, I applied to the Board of Revenue, for a few fair average samples of the cotton soils, of the Bellary, Coimbatore, Cuddapah, and Tinnevelly Districts. In their Proceedings, No. 9,578, dated the 22nd of October, the Board directed the Collectors of the districts referred to, to procure the specimens of the soils required and, to forward them to Sydapet.

68. Early in December, twelve specimens of cotton soils were received from the Collector of Cuddapah, and Mr. Schiffmayer's services being then available, I gave the samples to him for examination, in view, chiefly, to determine the physical properties of the soils. He selected for examination, the four specimens of the soils referred to in the following statement:—

Number of the sample.	Taluq.	Village.	Land from which the specimen was taken.
1	Jammalamadugu Taluq.	Pedda Pasupula ...	From survey field, No. 320.
2		Jungalapally ...	From survey dry field, No. 475, belonging to the putta of Balagungulugari Gungunna.
3		Chinna Mudium ...	From survey field, No. 63.
4		Pedda Mudium ...	From survey field, No. 329.

He, at the same time, took two samples of the soils of the Experimental Farm, for examination along with the cotton soils; these, were numbered, No. 5 and No. 6.

Organic matter in each soil.

69. The first step, in the investigation, was the determination of the amount of organic matter in each soil. For easy comparison, the organic matter was determined after the soils had been dried to a uniform degree of dryness. The following statement shows, the amount of organic matter found in each soil:—

	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of soil after heating to 220 degrees...	10·000	10·000	10·000	10·000	10·000	10·000
Weight of soil after combustion of the organic matter	9·397	9·701	9·607	9·425	9·758	9·808
Loss of weight	0·603	0·299	0·393	0·575	0·242	0·192
Organic matter, per cent.	6·03	2·99	3·93	5·75	2·42	1·92

"It will be seen that the organic matter was determined from soils, from which the moisture had been expelled. The results obtained, by adopting this course, are more readily

compared. The percentage of moisture in natural soils is not constant, but subject to great variation from changes in climate. Although these soils were heated, in the sand bath, up to 220 degrees Fahr., the whole of the hygroscopic moisture was not expelled, and the amount of organic matter may be stated a trifle too high."

Capacity to hold water.

70. The next step was the determination of the capacity of the soils to absorb moisture from the atmosphere, when in layers of 0·22 inches deep. The following statement shows this:—

Time when weighed.	No. 1. Weight of soil.	No. 2. Weight of soil.	No. 3. Weight of soil.	No. 4. Weight of soil.	No. 5. Weight of soil.	No. 6. Weight of soil.	Temperature when observation made.	
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.		
21st January 1876, 9 A.M.	20·000	20·000	20·000	20·000	20·000	20·000	....	In the Laboratory.
Do. do. 5 P.M.	19·987	19·980	19·983	19·987	19·983	19·958	79	
22nd do. 7 A.M.	19·990	19·988	19·991	19·991	19·987	19·959	76	
Do. do. 5 P.M.	20·008	19·996	20·001	20·006	19·985	19·958	79	
23rd do. 7 A.M.	19·997	19·991	19·998	19·995	19·986	19·958	76	
24th do. 7 A.M.	19·989	19·991	19·996	19·994	19·987	19·959	76	
25th do. 7 A.M.	19·996	19·993	19·998	19·999	19·988	19·960	76	
Do. do. 5 P.M.	20·016	20·001	20·006	20·010	19·987	19·959	79	
26th do. 7 A.M.	20·013	19·999	20·006	20·013	19·988	19·958	74	
Do. do. 5 P.M.	19·938	19·970	19·964	19·960	19·962	19·941	79	
27th do. 7 A.M.	19·916	19·963	19·953	19·945	19·969	19·934	74	
Do. do. 5 P.M.	19·905	19·953	19·937	19·905	19·960	19·925	79	
28th do. 5 P.M.	19·856	19·945	19·923	19·894	19·952	19·918	79	
29th do. 7 A.M.	19·869	19·951	19·926	19·911	19·968	19·931	74	
Do. do. 5 P.M.	19·914	19·968	19·950	19·935	19·969	19·932	80	
31st do. 7 A.M.	19·931	19·972	19·960	19·951	19·976	19·935	75	
1st February do. 7 A.M.	20·664	20·389	20·514	20·574	20·180	20·150	64	Exposed out of Laboratory windows door, temperature observed out of door. kept open during day and night.
Do. do. 5 P.M.	18·725	19·570	19·280	19·194	19·905	19·870	80	
2nd do. 7 A.M.	20·323	20·304	20·372	20·377	20·193	20·136	65	
Do. do. 5 P.M.	18·823	19·628	19·385	19·219	19·892	19·857	84	
3rd do. 7 A.M.	20·121	20·244	20·300	20·361	20·137	20·092	65	

71. It will readily be understood that, a soil which condenses vapor readily from the air, possesses the means of resisting, to a considerable extent, the effects of a drought. The quantity of this moisture in the soil varies with every change in the temperature, lessening during day, and increasing during night. As the preceding statement shows, the absorption of moisture from the air depends very greatly on the character of the soil.

"For these analyses 20 grams of each soil were taken, and, put separately in zinc trays measuring 4 inches square and 1½ inches in depth, the soils being in layers of 0·22 inches. The soils, while under observation, were kept in the Laboratory for the first ten days and, exposed freely out of doors during the remainder of the period. It will be noticed that, the soils absorbed but little moisture while in the Laboratory, in comparison with what they absorbed when exposed out of doors. Soil No. 1, took up 7·99 per cent. of water during a night."

Capacity to absorb water from a saturated atmosphere.

72. The next stage in the inquiry was, the determination of the capacity of the soils, to absorb moisture from a saturated atmosphere, when exposed, in layers of 0·22 inches deep. The following statement, affords this information:—

STATEMENT No. III.

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of the soils on the 3rd February 1876 at 8 A.M. after exposure to the night air...	20·1215	20·2440	20·3000	20·3610	20·1370	20·0920
Weight of the soils on the 10th February 1876 at 8 A.M. after being under a glass cover for seven days	20·9015	20·3710	20·5550	20·6800	20·1410	20·0930
Weight of the soils on the 14th February 1876 at 8 A.M. after being under a glass cover for eleven days	21·0125	20·3950	20·6330	20·7340	20·1410	20·0780
The soils took water from the atmosphere after being under a glass cover for seven days	·7800	·1270	·2550	·3190	·0040	·0010
The soils took water from the atmosphere after being under a glass cover for eleven days	·8910	·1510	·3330	·3730	·0040	...
The soil No. 6 lost water after being under a glass cover for eleven days	...	...	...	...	...	·0140

"The soils were placed on sheets of glass resting over trays filled with water, and the whole were placed under a glass globe made air-tight. The soils were kept in this way, in the Laboratory for seven days, at the expiration of which time, the cover was removed and the soils weighed. After weighing, the soils were again put under cover, as previously, for four days longer, to ascertain, whether they would take up any more moisture. The temperature under the globe was slightly lower than that of the Laboratory. It will be observed that the absorption of moisture increased in the cotton soils, during the second period of exposure to the saturated atmosphere, whereas the Sydapet Farm's soils, lost moisture. It is probable that these latter had absorbed during the first two or three days of exposure, all the moisture they could condense."

73. The next statement shows, the amount of water each soil contained, after having been exposed to the saturated atmosphere ;—

STATEMENT No. IV.

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of the soils immediately after exposure to saturated atmosphere ...	21·0125	20·3950	20·6330	20·7340	20·1410	20·0390
Weight of soil immediately after drying in sand bath, 212 degrees	18·1135	19·3880	19·1730	18·7200	19·8410	19·8160
Water in the soils after exposure to saturated atmosphere per cent.	14·4950	5·0350	7·3000	10·0700	1·5000	1·1150

"Under natural conditions, soils seldom condense so much moisture as in the case of the soils experimented with. The air, is never uniformly saturated, for several days, to the same extent as, the atmosphere over the soils during the experiment."

74. The statement that follows shows, the percentage of water in the soils when taken for the examinations detailed in statements Nos. 2 and 4 ;—

——	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Weight of air dry soil, at the commencement of analysis	20·0000	20·0000	20·0000	20·0000	20·0000	20·0000
Weight of soil after drying in sand bath..	18·1135	19·3880	19·1730	18·7200	19·8410	19·8160
The air dry soil contained per cent. of water	9·4325	3·0600	4·1350	6·4000	0·7950	0·9200

I would particularly direct attention to the above table, it will be seen that, while the sandy soils of the Farm contained on the average only about $\frac{3}{4}$ per cent. of moisture, the cotton soils contained, on the average, nearly 6 per cent. or, in other words, the Farm soil, to a depth of 6 inches contained only about $7\frac{1}{2}$ tons of moisture per acre, whereas, an acre of the cotton soil to the same depth, contained 60 tons, estimating that one acre, of either soil, to a depth of 6 inches, will weigh 1,000 tons.

75. The next statement shows, the capacity of the soils to absorb moisture from the air during the night and, to retain it during the day, when exposed to the atmosphere, in layers of 0·33 inches and 0·66 inches deep;—

STATEMENT No. V.

Time when weighed.	Soil No. 1. Layer of Soil 0·33 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 1. Layer of Soil 0·66 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 2. Layer of Soil 0·33 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 2. Layer of Soil 0·66 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 3. Layer of Soil 0·33 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 3. Layer of Soil 0·66 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Temperature of atmosphere to which the soils were exposed immediately before weighing.
	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	
5-2-76 7 A.M.	30·000	...	...	60·000	...	...	30·000	...	...	60·000	...	...	30·000	...	...	60·000	...	...	75
7-2-76 5 P.M.	28·612	1·388	...	57·447	2·553	...	29·385	·615	...	58·697	1·303	...	28·930	1·070	...	57·898	2·102	...	82
8-2-76 5 P.M.	28·870	...	·258	57·883	...	·436	29·559	...	·174	59·094	...	·397	29·224	...	·294	58·208	...	·310	81
9-2-76 7 A.M.	29·810	...	·940	58·913	...	1·030	30·089	...	·530	59·936	...	·842	30·014	...	·790	59·290	...	1·082	64
9-2-76 5 P.M.	28·295	1·515	...	56·826	2·087	...	29·265	·824	...	58·727	1·209	...	28·984	1·030	...	57·848	1·442	...	84
10-2-76 7 A.M.	29·559	...	1·264	58·354	...	1·528	30·153	...	·888	59·817	...	1·090	29·950	...	·966	59·156	...	1·308	65
10-2-76 5 P.M.	28·370	1·189	...	56·924	1·430	...	29·413	·740	...	58·794	1·023	...	29·098	·852	...	58·155	1·001	...	81
11-2-76 7 A.M.	29·692	...	1·322	58·480	...	1·556	30·201	...	·788	59·861	...	1·067	30·060	...	·962	59·410	...	1·255	65
11-2-76 5 P.M.	28·700	·992	...	57·846	1·134	...	29·432	·769	...	58·785	1·076	...	28·951	1·109	...	58·050	1·360	...	81
12-2-76 7 A.M.	30·445	...	1·745	59·345	...	1·999	30·620	...	1·188	60·264	...	1·479	30·500	...	1·549	59·802	...	1·752	65
12-2-76 5 P.M.	29·047	1·398	...	58·173	1·172	...	29·683	·937	...	59·291	·973	...	29·397	1·103	...	58·775	1·027	...	82
13-2-76 7 A.M.	30·524	...	1·477	59·826	...	1·653	30·591	...	·908	60·435	...	1·144	30·595	...	1·198	60·158	...	1·383	66
14-2-76 7 A.M.	30·287	·237	...	59·723	·103	...	30·448	·143	...	60·280	·155	...	30·440	·155	...	60·030	·128	...	66
14-2-76 5 P.M.	28·899	1·388	...	58·215	1·508	...	29·614	·834	...	59·244	1·036	...	29·312	1·128	...	58·762	1·268	...	81

Time when weighed.	Soil No. 4. Layer of Soil 0·33 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 4. Layer of Soil 0·66 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 5. Layer of Soil 0·33 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 5. Layer of Soil 0·66 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 6. Layer of Soil 0·33 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Soil No. 6. Layer of Soil 0·66 inches thick. Weight of Soil used.	Moisture. Loss.	Gain.	Temperature of atmosphere to which the soils were exposed immediately before weighing.
	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	
5-2-76 7 A.M.	30·000	...	...	60·000	...	...	30·000	...	...	60·000	...	...	30·000	...	...	60·000	...	...	75
7-2-76 5 P.M.	28·475	1·525	...	57·410	2·590	...	29·806	·194	...	59·492	·508	...	29·767	·233	...	59·494	·506	...	82
8-2-76 5 P.M.	28·720	...	·245	57·677	...	·267	29·871	...	·065	59·654	...	·162	29·819	...	·052	59·460	·034	...	81
9-2-76 7 A.M.	29·960	...	1·240	58·910	...	1·233	30·072	..	·201	60·006	...	·352	30·050	...	·231	59·988	...	·528	64
9-2-76 5 P.M.	28·944	1·016	...	57·413	1·497	...	29·826	·246	...	59·547	·459	...	29·803	·247	...	59·565	·423	...	84
10-2-76 7 A.M.	30·002	...	1·058	58·757	...	1·344	30·098	...	·272	60·431	...	·884	30·080	...	·277	60·022	...	·457	65
10-2-76 5 P.M.	29·230	·772	...	57·644	1·113	...	29·861	·237	...	59·056	1·375	...	29·839	·241	...	59·613	·409	...	81
11-2-76 7 A.M.	30·297	...	1·067	58·855	...	1·211	30·100	...	·239	59·452	...	·396	30·081	...	·242	60·030	...	·417	65
11-2-76 5 P.M.	29·138	1·159	...	57·662	1·193	...	29·831	·269	...	58·946	·506	...	29·803	·278	...	59·528	·502	...	81
12-2-76 7 P.M.	30·632	...	1·494	59·473	...	1·811	30·505	...	·674	59·864	...	·918	30·578	...	·775	60·382	...	·854	65
12-2-76 5 P.M.	29·316	1·316	...	58·203	1·270	...	29·883	·622	...	59·064	·800	...	29·860	·718	...	59·640	·742	...	82
13-2-76 7 A.M.	30·653	...	1·337	59·765	...	1·562	30·381	...	·498	59·780	...	·716	30·420	...	·560	60·313	...	·673	66
14-2-76 7 A.M.	30·438	·215	...	59·571	·194	...	30·275	·106	...	59·651	·129	...	30·255	·165	...	60·190	·123	...	66
14-2-76 5 P.M.	29·226	1·212	...	58·150	1·421	...	29·867	·408	...	59·034	·617	...	29·838	·417	...	59·612	·578	...	81

76. The next statement shows, the results obtained with these soils, in the absorption of moisture from the air, when exposed in their natural condition and, when exposed after being mixed with 20 per cent. of organic and, 20 per cent. of mineral manures;—

Capacity to take up moisture after being manured.

Statement No. VI.

Time when weighed.	Soil No. 1. A, in natural condition. Weight of Soil.	Moisture. Loss.	Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Gain.	Soil No. 2. A, in natural condition. Weight of Soil.	Moisture. Loss.	Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Gain.	Soil No. 3. A, in natural condition. Weight of Soil.	Moisture. Loss.	Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Gain.	Temperature.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Grams.	Grms.	Grams.	Grams.	Grams.	Grams.	Gms.	Gms.	Gms.
16-2-76 4 P.M. ...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	80
17-2-76 5 P.M. ...	19·077	·923	...	18·975	1·025	...	19·193	·807	...	19·635	·365	...	19·415	·585	...	19·681	·319	...	19·409	·591	...	19·195	·805	...	19·469	·531	...	82
18-2-76 7 A.M. ...	20·143	...	1·066	20·161	...	1·186	20·265	...	1·072	20·191	...	·556	20·267	...	·852	20·251	...	·570	20·207	...	·798	20·190	...	·995	20·190	...	·721	65
18-2-76 5 P.M. ...	18·739	1·404	...	18·714	1·447	...	18·974	1·291	...	19·518	·673	...	19·347	·920	...	19·685	·566	...	19·297	·910	...	19·150	1·040	...	19·407	·783	...	83
19-2-76 7 A.M. ...	20·161	...	1·422	20·125	...	1·411	20·225	...	1·251	20·153	...	·635	20·189	...	·842	20·172	...	·487	20·225	...	·928	20·188	..	1·038	20·179	...	·772	68
19-2-76 5 P.M. ...	18·988	1·173	...	18·889	1·236	...	19·103	1·122	...	19·580	·573	...	19·417	·772	...	19·699	·473	...	19·355	·870	...	19·195	·993	...	19·443	·736	...	84
20-2-76 7 A.M. ...	20·451	...	1·463	20·359	...	1·470	20·423	...	1·320	20·271	...	·691	20·345	...	·928	20·273	...	·574	20·332	...	·977	20·317	...	1·122	20·294	...	·851	66
20-2-76 5 P.M. ...	18·927	1·524	...	18·793	1·566	...	19·000	1·423	...	19·554	·717	...	19·391	·954	...	19·693	·580	...	19·329	1·003	...	19·153	1·164	...	19·408	·886	...	84
21-2-76 7 A.M. ...	20·383	...	1·456	20·275	...	1·482	20·357	...	1·357	20·226	...	·672	20·284	...	·893	20·224	...	·531	20·290	...	·961	20·265	...	1·112	20·251	...	·843	66

Time when weighed.	Soil No. 4. A, in natural condition. Weight of Soil.	Moisture. Loss.	Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Gain.	Soil No. 5. A, in natural condition. Weight of Soil.	Moisture. Loss.	Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Gain.	Soil No. 6. A, in natural condition. Weight of Soil.	Moisture. Loss.	Gain.	B, mixed with organic manure. Weight of Soil.	Moisture. Loss.	Gain.	C, mixed with mineral manure. Weight of Soil.	Moisture. Loss.	Gain.	Temperature.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Gms.	Gms.	Grams.	Grams.	Grms.	Grams.	Grams.	Grams.	Grams.	Gms.	Gms.	Gms.
16-2-76 4 P.M. ...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	..	...	20·000	...	...	20·000	...	...	20·000	...	...	20·000	...	..	80
17-2-76 5 P.M. ...	19·198	·802	...	19·071	·929	...	19·379	·621	...	19·908	·092	...	19·685	·315	...	19·906	·094	...	19·916	·084	...	19·721	·279	...	19·926	·074	...	82
18-2-76 7 A.M. ...	20·215	...	1·017	20·170	...	1·099	20·287	...	·908	20·086	...	·178	20·164	...	·479	20·091	...	·185	20·082	...	·166	20·170	...	·449	20·111	...	·185	65
18-2-76 5 P.M. ...	19·196	1·019	...	19·031	1·139	...	19·355	·932	...	19·909	·177	...	19·687	·477	...	19·902	·189	...	19·916	·166	...	19·622	·548	...	19·930	·181	...	83
19-2-76 7 A.M. ...	20·300	...	1·104	20·119	...	1·088	20·189	...	·834	20·070	...	·161	20·143	...	·456	20·074	...	·172	20·073	...	·157	20·044	...	·422	20·073	...	·143	68
19-2-76 5 P.M. ...	19·262	1·038	...	19·089	1·030	...	19·355	·834	...	19·914	·156	...	19·684	·459	...	19·907	·167	...	19·925	·148	...	19·622	·422	...	19·930	·143	...	84
20-2-76 7 A.M. ...	20·455	...	1·193	20·285	...	1·196	20·325	...	·970	20·124	...	·210	20·224	...	·540	20·154	...	·247	20·136	...	·211	20·132	...	·510	20·151	...	·221	66
20-2-76 5 P.M. ...	19·227	1·228	...	19·081	1·204	...	19·351	·974	...	19·894	·230	...	19·664	·560	...	19·890	·264	...	19·910	·226	...	19·614	·518	...	19·915	·236	...	84
21-2-76 7 A.M. ...	20·406	...	1·179	20·232	...	1·151	20·269	...	·918	20·101	...	·207	20·176	...	·512	20·113	...	·223	20·105	...	·195	20·081	...	·467	20·002	...	·087	66

"Zinc trays, measuring 4 inches square and 1 inch in depth, were used in this experiment. The results in column A, were obtained with 20 grams of soil, those in column B, with 16 grams of soil, mixed with 4 grams of organic matter (saw dust), and. those in column C, with 16 grams of soil mixed with 4 grams of mineral manure (cow-dung ashes). The saw dust was taken from a saw pit. It was first steeped for a few days and, afterwards exposed to the sun, in order to hasten decomposition; after drying, it was sifted through a sieve with meshes measuring 0·75 millimeters. It will be noticed that the soils were greatly improved in their powers of absorbing moisture from the air, by being mixed with organic matter, this, was specially the case with the soils of the Sydapet Experimental Farm, *which, after the addition of the organic matter, condensed three times as much moisture from the air, as they were previously able.*"

The results brought to light in this portion of the experiment are of *great practical importance.* They show, that ashes of dung or of any other substance have little or no effect in increasing the moisture condensing powers of a soil. Thus, as regards the soils of the Sydapet Experimental Farm, it will be seen that, while an addition to the soils of 25 per cent. in weight, of mineral manures, produced scarcely a perceptible effect, in increasing their condensing powers, the addition of a similar quantity of organic manure, increased their condensing powers, as Mr. Schiffmayer points out, in the foregoing extract, nearly 300 per cent. Of course, in actual practice, such a quantity of manure as would represent 25 per cent. of the weight of an ordinary soil, 6 inches deep could never be applied at one time; but, under good farming, the organic matter in the soil will gradually increase in quantity. As a general rule native farming, exhausts the organic matter in the soil, and thus, renders the soil less able to take up moisture from the air—*a very serious result in this country.*

Great effect of organic manure in increasing condensing powers of the soil.

Native farming reduces organic matter in the soil.

77. The next stage, in the inquiry, was the determination of the capacity of the different soils to take up water vapor from the atmosphere, when exposed to the air in different degrees of fineness:—

Effect of perfect tillage in the absorptive powers of a soil.

STATEMENT No. VII.

Time when weighed.		Soil No. 1.						Soil No. 2.						Soil No. 3.						Temperature.
		A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			
		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		
			Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.	
		Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	
23-2-76	5 P.M.	30·000	...	...	30·000	...	...	30·000	...	...	30·000	...	...	30·000	...	...	30·000	...	...	82
24-2-76	7 A.M.	30·577	...	·577	30·486	...	·486	30·334	...	·334	30·373	...	·373	30·419	...	·419	30·392	...	·392	67
24-2-76	5 P.M.	28·579	1·998	...	28·698	1·788	...	29·444	·890	...	29·162	1·211	...	29·141	1·278	...	29·096	1·296	...	86
25-2-76	7 A.M.	30·122	...	1·543	30·146	...	1·448	30·254	...	·810	30·307	...	1·145	30·271	...	1·130	30·204	...	1·108	72
25-2-76	5 P.M.	28·435	1·687	...	28·749	1·397	...	29·410	·844	...	29·237	1·070	...	29·018	1·253	...	28·950	1·254	...	85
26-2-76	7 A.M.	29·789	...	1·354	30·019	...	1·270	30·193	...	·783	30·189	...	·952	30·134	...	1·116	30·051	...	1·101	74
26-2-76	5 P.M.	28·270	1·519	...	28·174	1·845	...	29·336	·857	...	28·925	1·264	...	29·022	1·112	...	28·719	1·332	...	87
27-2-76	7 A.M.	29·826	...	1·556	29·834	...	1·660	30·162	...	·826	30·151	...	1·226	30·177	...	1·155	30·070	...	1·351	72
27-2-76	5 P.M.	28·757	1·069	...	28·914	·920	...	29·622	·540	...	29·507	·644	...	29·331	·796	...	29·390	·680	...	85
28-2-76	7 A.M.	29·802	...	1·045	29·852	...	·938	30·132	...	·510	30·149	...	·642	30·085	...	·704	30·069	...	·679	70

Time when weighed.		Soil No. 4.						Soil No. 5.						Soil No. 6.						Temperature.
		A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			A, in fine state.			B, in rough state.			
		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		Weight of Soil.	Moisture.		
			Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.		Loss.	Gain.	
		Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	Grms.	Gms.	Gms.	
23-2-76	5 P.M.	30·000	...	...	30·000	...	...	30·000	...	...	30·000	...	...	30·000	...	...	30·000	...	...	82
24-2-76	7 A.M.	30·466	...	·466	30·427	...	·427	30·166	...	·166	30·171	...	·171	30·157	...	·157	30·180	...	·180	67
24-2-76	5 P.M.	28·958	1·508	...	29·239	1·188	...	29·841	·325	...	29·843	·328	...	29·863	·294	...	29·766	·414	...	86
25-2-76	7 A.M.	30·312	...	1·354	30·222	...	·983	30·124	...	·283	30·127	...	·284	30·117	...	·254	30·078	...	·312	72
25-2-76	5 P.M.	28·786	1·526	...	28·724	1·498	...	29·820	·304	...	29·806	·321	...	29·856	·261	...	29·768	·310	...	85
26-2-76	7 A.M.	30·092	...	1·306	29·962	...	1·238	30·098	...	·278	30·112	...	·306	30·094	...	·238	30·066	...	·298	74
26-2-76	5 P.M.	28·686	1·406	...	28·763	1·199	...	29·778	·320	...	29·773	·339	...	29·827	·267	...	29·730	·336	...	87
27-2-76	7 A.M.	30·130	...	1·444	30·081	...	1·318	30·083	...	·305	30·098	...	·325	30·073	...	·246	30·026	...	·296	72
27-2-76	5 P.M.	29·209	·921	...	29·319	·762	...	29·862	·221	...	29·874	·224	...	29·860	·213	...	29·806	·220	...	85
28-2-76	7 A.M.	30·012	...	·803	30·024	...	·705	30·096	...	·224	30·122	...	·248	30·068	...	·208	30·052	...	·246	70

" The soil, used for the results noted under column A, was sifted through a sieve with meshes of 1·5 millimeters. The other soil, was first sifted through a sieve with meshes of 8·0 millimeters, and, the fine soil was afterwards removed from it by passing it over a sieve with meshes of 6·0 millimeters, that which remained on the sieve, being taken for examination. From these results it will be seen that the fine soils of samples No. 1, No. 3, and No. 4, absorbed more moisture

than the rough portions of the same samples ; and that, the other soils which contained less clay and less organic matter, absorbed more moisture when rough, than when fine."

Capability of air dry soil to hold liquid water.

78. The next statement records the results obtained in an endeavour to ascertain how much liquid water, air dry soils can hold in their pores, when in a natural state:—

STATEMENT No. VIII.

Date of operation.	No. of soils.	Weight of air dry soil.	Water appeared on surface.	Time when weighed after water appeared on the surface.	Weight of the soil at these various times.	Air dry soil held water in its pores.	Soil increased in bulk after saturation.	Soil decreased in bulk after saturation.
		Grams.	Hours.	Hours.	Grams.	Per cent.	Per cent.	Per cent.
5-3-76 ...	No. 1	280·15	8 ¼	½	373·89			
				2	375·60			
				3 ½	377·28	34·67	8·33	
5-3-76 ...	No. 2	338·02	1 ¾	¼	422·03			
				1 ¾	424·02			
				3 ½	424·36	25·55	0·83	
5-3-76 ...	No. 3	287·35	1 ¾	¼	377·99			
				1 ¾	378·05			
				3 ½	378·10	31·58	4·16	
5-3-76 ...	No. 4	306·79	6 ¼	½	398·86			
				2	400·50			
				3 ½	401·25	30·79	6·66	
5-3-76 ...	No. 5	345·82	1	¼	433·63			
				1 ¾	435·36			
				3 ½	435·56	25·95		6·66
5-3-76 ...	No. 6	338·54	¾	¼	413·25			
				1 ¾	415·81			
				3 ¼	416·13	22·92		8·33

"The boxes used in these experiments were made of zinc, each measured 6½ inches in depth and were 2·25 inches square. The bottom of each, was perforated with numerous holes, over which was laid a piece of fine linen previously moistened. The weight of the box having been determined, it was gradually filled to 6 inches in depth with soil, and the weight of the whole was again determined. Next, the box with the soil was immersed in water to a depth of 2 or 3 millimeters. It will be seen that, the water moved but slowly upwards in the soils containing most clay and organic matter. *In soil No.* 1, *the water occupied* 8¼ *hours in reaching the surface, while in the soil No.* 6, *of the Sydapet Experimental Farm, it reached the surface in* ¾ *of an hour.* Soils in *a fine state*, will hold more water than soils of which the particles are coarse. Hence, soil No. 2 held less water than soil No. 5, although, the former of these was much richer in organic matter and clay, the good effect of which, was neutralized, by the coarse particles in which the soil was divided, there being necessarily in it much fewer *capillary* tubes. The soils which contained most clay, increased in bulk, while, the sandy soils decreased in bulk. It should be noted, that the figures denote the amount of water the soils held, above that which they contain, in the air dry state; if, the absolute capacity to hold moisture is calculated, the difference between the soils examined, would be much greater than, the figures show."

79. The next table gives the results of an experiment made to determine the readiness with which water evaporates from different soils in their natural condition when saturated to their utmost capacity :—

Statement No. IX.

Time when weighed.	Soil No. 1.			Soil No. 2.			Soil No. 3.			Soil No. 4.			Soil No. 5.			Soil No. 6.			Temperature observed before weighing.
	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	
	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	Grams.	Grams	Grams	
Wet soils weigh	377·28	...	...	424·36	...	...	378·10	...	...	401·25	...	...	435·56	...	...	416·13	...	...	...
After 24 hours	366·16	11·12	...	408·60	15·76	...	367·25	10·81	...	390·35	10·90	...	421·90	13·66	...	404·58	11·55	...	92
,, 48 ,, ...	359·73	17·55	6·43	399·40	24·96	9·20	361·75	16·35	5·54	384·10	17·15	6·25	411·55	24·01	10·35	397·28	18·85	7·30	92
, 72 ,, ...	355·03	22·25	4·70	391·50	32·86	7·90	357·00	21·10	4·75	379·50	21·75	4·60	399·80	35·76	11·75	389·13	27·00	8·15	92
,, 96 ,, ...	351·53	25·75	3·50	386·75	37·61	4·75	353·15	24·95	3·85	376·10	25·15	3·40	389·20	46·36	10·60	381·88	34·25	7·25	92
,, 120 ,, ...	349·31	27·97	2·22	382·70	41·66	4·05	349·45	28·65	3·70	372·70	28·55	3·40	379·70	55·86	9·50	375·23	40·90	6·65	93
,, 144 ,, ...	345·88	31·40	3·43	379·00	45·36	3·70	346·20	31·90	3·25	370·00	31·25	2·70	373·70	62·86	7·00	368·93	47·20	6·30	93
,, 168 ,, ...	342·78	34·50	3·10	377·00	47·36	2·00	343·10	35·00	3·10	367·30	33·95	2·70	370·05	65·51	2·65	363·85	52·28	5·08	94
,, 192 ,, ...	341·53	35·75	1·25	375·10	49·26	1·90	340·15	37·95	2·95	364·25	37·00	3·05	366·80	68·76	3·25	359·48	56·65	4·37	97
,, 216 ,, ...	339·53	37·75	2·00	373·55	50·81	1·55	338·10	40·00	2·05	362·70	38·55	1·55	365·15	70·41	1·65	357·33	58·80	2·15	104
,, 240 ,, ...	336·28	41·00	3·25	371·50	52·86	2·05	335·65	42·45	2·45	360·30	40·95	2·40	363·10	72·46	2·05	354·88	61·25	2·45	102
,, 264 ,, ...	334·58	42·70	1·70	369·50	54·86	2·00	333·35	44·75	2·30	358·15	43·10	2·15	361·80	73·76	1·30	352·93	63·20	1·95	106
,, 288 ,, ...	333·48	43·80	1·10	367·70	56·66	1·80	331·15	46·95	2·20	355·90	45·35	2·25	360·35	75·21	1·45	350·18	65·95	2·75	108
,, 312 ,, ...	331·78	45·50	1·70	366·20	58·16	1·50	329·35	48·75	1·80	354·09	47·16	1·81	359·20	76·36	1·15	348·75	67·38	1·43	106
,, 336 ,, ...	330·08	47·20	1·70	364·55	59·81	1·65	327·75	50·35	1·60	352·20	49·05	1·89	358·25	77·31	·95	347·38	68·75	1·37	102

—	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Air dry soil held water	34·67	25·55	31·58	30·79	25·95	22·92
Water evaporated during 336 hours	16·84	17·98	17·52	15·98	22·35	20·30
Soil retained absorbed water, after evaporation for 336 hours.	17·83	7·57	14·06	14·81	3·60	2·62
Air dry soil contained water according to Experiment No. III.	9·4325	3·0600	4·1350	6·4000	0·7950	0·9200
Total amount of water in soil, after evaporation for 336 hours.	27·2625	10·6300	18·1950	21·2100	4·3950	3·5400

"The zinc boxes used in the experiments recorded in statement No. 8, were used in the foregoing experiments. The soils, were exposed to the full heat of the sun from 9 A.M. until 3 P.M. daily, for fourteen days. During the remaining part of each day, they were kept in a room before a partially opened window. On one day, the 3rd of April, the soils were kept in the room during the whole day. The temperature was observed daily at 3 P.M., at which time also the soils were weighed. It will be noted that the evaporation was more rapid, the less was the capacity of the soils to hold water. After exposure for 336 hours, soil *No.* 1 *which had taken up* 34·67 *per cent. of moisture, retained as much as* 17·83 *per cent. and soil No.* 6, *which had taken up* 22·92 *per cent. of water, retained at the same time only* 2·62 *per cent.* Further, the total amount of water in the soil, that is, the water containd in the air dry soil, added to the water taken up in the experiment, was, after the expiration of the time mentioned, *in No.* 1, 27·2625 *per cent. while, in soil No.* 6, *it was only* 3·54 *per cent.*, so that, whilst No. 1, was too wet for tillage operations, No. 6, was altogether too dry. All the stiff soils were cracked, especially No. 1, and No. 4, the result of the increase in bulk after saturation and, the subsequent decrease in bulk on drying. The cracks, extended down in the soils to about one-third of their depth, below this, the soils were plastic. The sandy soils on the surface were very hard, the result of their decrease in bulk after saturation; their finer particles having been washed down into the pores, and, the whole cemented together like concrete."

80. The next experiment, was made to ascertain the amount of liquid water, the soil would absorb when mixed with 5 per cent. of organic matter :—

STATEMENT No. X.—(*Continued*).

Date.	No. of Soil.	Weight of air-dry Soil.	Water appeared on the Surface.	Time when weighed after the water appeared on the Surface.	Weight of wet Soil at these various times.	Air-dry Soil absorbed water.	Water absorbed by the Soil in the depth of 6 inches is equal to a rainfall in inches.	Soil increased in bulk after saturation with water.	Soil decreased in bulk after saturation with water.	No. of Soil.	Weight of air-dry Soil.	Water appeared on the Surface.	Time when weighed after the water appeared on the Surface.	Weight of wet Soil at these various times.	Air-dry Soil absorbed water.	Water absorbed by the Soil in the depth of 6 inches is equal to a rainfall in inches.	Soil increased in bulk after saturation with water.	Soil decreased in bulk after saturation with water.
		Grams.	Hours.	Hours.		Per cent.	Inches.	Per cent.	Per cent.		Grams.	Hours.	Hours.		Per cent.	Inches.	Per cent.	Per cent.
22-3-76.	No. 1.	250	$9\frac{1}{2}$	$\frac{1}{2}$	346·50					No. 4	260	$6\frac{3}{4}$	$\frac{1}{2}$	355·95				
				$2\frac{3}{4}$	348·50								3	357·95				
				5	349·7		2·72	3·33	...				$5\frac{1}{2}$	358·85				
				7	350·4	40·16							$7\frac{1}{2}$	359·95				
													$9\frac{1}{2}$	360·55	38·67	2·72	1·66	...
22-3-76.	No. 2.	290	$2\frac{1}{4}$	$\frac{1}{4}$	379·88					No. 5	280	$1\frac{1}{4}$	$\frac{1}{4}$	376·8				
				$2\frac{1}{4}$	380·95								$1\frac{3}{4}$	378·9				
				$4\frac{1}{4}$	382·05								$3\frac{3}{4}$	380·4				
				7	382·85								$6\frac{1}{4}$	381·4				
				$9\frac{1}{4}$	383·85								9	382·1				
				$11\frac{3}{4}$	384·85	32·70	2·57	...	...				$11\frac{1}{4}$	383·0				
													$13\frac{1}{4}$	383·2	36·85	2·79	...	0·83
22-3-76.	No. 3.	250	$4\frac{3}{4}$	$\frac{1}{4}$	338·55					No. 6	280	$1\frac{1}{2}$	$\frac{1}{4}$	362·9				
				$2\frac{1}{4}$	339·55								$1\frac{1}{4}$	365·9				
				$4\frac{3}{4}$	340·85								$3\frac{1}{2}$	367·1				
				7	342·65								$5\frac{1}{2}$	367·1	31·10	2·36	...	1·66
				$9\frac{1}{4}$	343·85													
				$11\frac{1}{4}$	344·15	37·66	2·55	0·83	...									

—	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Pe cen t.
Air-dry soil, mixed with 5 per cent. of organic manure held water ...	40·16	32·70	37·64	38·28	36·85	34·67
Air-dry natural soil held water ...	34·67	26·55	31·58	30·79	25·95	22·92
Soil after mixed with 5 per cent. of organic manure held more water ...	5·49	7·15	6·06	7·49	10·90	11·75

" These experiments were similar to those of which the results are given in statement No. 8, except, that, only 5 per cent. of organic matter was added to the soils. *It will be seen that the*

water moved more slowly upwards than, in the natural soil; also that, the soils manured, held much more water than the unmanured soil and that, an addition of 5 *per cent. of organic matter to the Sydapet soils increased their powers to take up moisture* 10 *per cent."*

Evaporation from soils.

81. The next, and last, experiment was made to determine the readiness with which water evaporated from the different soils when mixed with 5 per cent. of organic manure and, saturated to their utmost capacity :—

STATEMENT No. XI.

Time when weighed.	Soil No. 1.			Soil No. 2.			Soil No. 3.			Soil No. 4.			Soil No. 5.			Soil No. 6.			Temperature observed before weighing.
	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	Weight of Soil.	Water evaporated.	Water evaporated each day.	
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	
Wet Soils weigh ...	350·40	...	...	384·85	...	...	344·15	...	...	360·55	...	...	383·2	...	...	367·1	...	...	...
After 24 hours ...	341·20	9·20	...	376·55	9·30	...	331·55	12·60	...	350·75	9·80	...	373·1	10·10	...	354·4	12·70	...	101
Do. 48 do. ...	335·10	15·30	6·10	367·45	18·40	9·10	325·55	18·60	6·00	344·05	16·50	6·70	364·7	18·50	8·40	345·8	21·30	8·60	102
Do. 72 do. ...	330·60	19·80	4·50	357·65	28·20	9·80	320·70	23·45	4·85	339·25	21·30	4·80	354·7	28·50	10·00	336·55	30·55	9·25	105
Do. 96 do. ...	326·90	23·50	3·70	349·35	36·50	8·30	316·75	27·40	3·95	335·25	25·30	4·00	344·7	38·50	10·00	328·30	38·80	8·25	102
Do. 120 do. ...	324·2	26·20	2·70	344·20	41·65	5·15	314·05	30·10	2·70	332·25	28·30	3·00	337·4	45·80	7·30	322·40	44·70	5·90	102
Do. 144 do. ...	321·60	28·80	2·60	339·50	46·30	4·65	311·45	32·70	2·60	329·35	31·20	2·90	330·2	53·00	7·20	317·50	49·60	4·90	101
Do. 168 do. ...	319·5	30·90	2·10	335·95	49·90	3·60	309·25	34·90	2·20	326·45	34·10	2·90	323·3	59·90	6·90	314·10	53·00	3·40	101
Do. 192 do. ...	316·5	33·90	3·00	332·25	53·60	3·70	306·85	37·30	2·40	323·45	37·10	3·00	317·90	65·30	5·40	311·00	56·10	3·10	101
Do. 216 do. ...	314·2	36·20	2·30	329·35	56·50	2·90	304·55	39·60	2·30	320·55	40·00	2·90	314·50	68·70	3·40	308·20	58·90	2·80	104
Do. 240 do. ...	312·2	38·20	2·00	326·95	58·90	2·40	302·55	41·60	2·00	318·00	42·55	2·55	312·00	71·20	2·50	306·10	61·00	2·10	100
Do. 264 do. ...	310·00	40·40	2·20	324·35	61·50	2·60	300·35	43·80	2·20	315·35	45·20	2·65	309·60	73·60	2·40	304·10	63·00	2·00	100
Do. 288 do. ...	309·20	41·20	0·80	323·45	62·40	0·90	299·25	44·90	1·10	313·95	46·60	1·40	308·50	74·70	1·10	303·90	64·10	1·10	89
Do. 312 do. ...	307·80	43·10	1·90	321·75	64·10	1·70	297·45	46·70	1·80	311·85	48·70	2·10	306·30	76·90	2·20	301·10	66·00	1·90	108
Do. 336 do. ...	305·30	45·10	2·00	319·95	65·90	1·80	295·55	48·60	1·90	308·95	51·60	2·90	304·80	78·40	1·50	299·10	68·00	2·00	104

STATEMENT No. XI.

—	Soil No. 1.	Soil No. 2.	Soil No. 3.	Soil No. 4.	Soil No. 5.	Soil No. 6.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Air dry soil held water when mixed with 5 per cent. of organic manure	40·16	32·70	37·64	36·23	36·85	34·67
Water evaporated during 336 hours	18·04	22·72	19·44	19·84	28·00	24·28
Soil retained from absorbed water after evaporation of 336 hours	22·12	9·98	18·20	18·44	8·85	10·39

"For these determinations the boxes were used that were employed in carrying out the last-mentioned experiments. It will be observed that the soils retained more water after evaporation for 336 hours than in the experiment recorded in Statment No. IX, although the temperature was high when the experiment was made. The stiff soils were not cracked and remained more free and open. No. 1, being much more fit for tillage after 336 hours than, in the experiment before referred to, although the soil contained nearly 6 per cent. more of moisture."

82. These experiments are of great practical importance to all engaged in the cultivation of the soil in this country. Much credit is due to Mr. Schiffmayer, for the labor he has devoted to these inquiries and, for the way in which he has conducted them.

Black cotton soil of India and black earth of Russia nearly alike.

83. The origin of our black cotton soils is yet a matter of controversy amongst Geologists, some contend that they are chiefly composed of the residuary matters of decayed forests, while others, assert that, they are aqueous deposits. The late Sir R. Murchison held the opinion that the black earth of Russia which is very similar to the black cotton soils of this country, was deposited under water, and, probably formed the beds of inland seas, the deposit, having been reduced to its present state by atmospheric agencies, during the gradual uphevil of the country. This gradual exposure to the destructive effects of the atmosphere would, he thought, account for the non-appearance in these soils of shells and marine remains. Our black cotton soils, differ from the Russian black earths chiefly, in containing nodular calcareous concretions which, are not found in the latter. The black cotton soil of this country, like that of Russia, is met with on rocks and strata of all ages; at moderately high elevations, as well as, in low situations; in beds of from half an acre, to tracts of country of thousands of acres; in thickness, varying from 3 or 4 inches to, 20 feet. The general composition of both soils is very similar; the Russian soil is said to be much blacker than its representative, in this country but, this may, to some extent, be due to the greater dryness of the black soil of this country.

Black cotton soil of India sedimentary deposit.

84. It appears to be the opinion of Indian Geologists that, our black cotton soil is, a sedimentary deposit, which has been formed in shallow fresh water lakes; however, they, are not more able, than was the late Sir R. Murchison, in respect to the black earths of Russia, to bring forward any satisfactory proof.

MANURES.

BRICK-KILN ASHES.

85. Having used with moderately good results, a large quantity of brick-kiln ashes, I was anxious to learn their general composition and, requested Mr. Schiffmayer to submit a sample to chemical analysis which, he accordingly did.

86. The sample, contained 6 per cent. of moisture; 20·60 per cent., of the sample, was soluble in hydrochloric acid, of which 3 per cent. was soluble in

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NOTE.—The tables and extracts in para. 67 to para. 81 are from a Memorandum prepared by K. Schiffmayer, Esq., Assistan Superintendent, Government Farms.

water; of the 80 per cent., insoluble in hydrochloric acid 10·37 per cent. was soluble in boiling caustic potash; of the remainder, more than 60 per cent. consisted of sand and charcoal. In the portion soluble in hydrochloric acid, he found no less than 3·874 per cent. of phosphoric acid and, a fair percentage of potash, lime and soda.

Large quantity of Phosphoric acid found in ashes.

87. The fuel used, in the kilns is, chiefly wood, and this would not account for the large quantity of phosphoric acid found. It is, I believe, customary to use a small quantity of dried cow-dung fuel, when the kilns are first lighted, but, the quantity used is quite insufficient to account for the large percentage of phosphoric acid.

88. The only explanation that I can offer is, that, probably, the contractor, who, supplied the ashes to the Farm, obtained a portion of them in some "Burning Ground," instead of, from brick-kilns, as stated by him; it is impossible, I think, to account for such a large percentage of phosphoric acid except, on the supposition that, the ashes were those of some animal remains.

VILLAGE NIGHT-SOIL.

89. The night-soil, used in the following experiment was collected in the Wudder Settlement, on the Experimental Farm. Latrines were provided for the use of the people and, a scavenger was employed to collect and remove the solid excreta. At the ground, set apart for the purpose, the excreta was, as gathered, thrown up into a heap, and the whole was covered, each time, with a slight coating of ashes, to prevent any offensive smell. When the heap had accumulated to about 20 or 25 cart loads, it was finally covered with ashes and soil; and, a fresh heap was begun. After lying in the heap for about eight or nine months, the night-soil was found to be quite deodoriz ed and, fit for use in the field. It must be remembered, that *the liquid excreta was not collected, and this, contains* $\frac{5}{6}$ *of the valuable constituents of the whole mixed excreta of man.*

Night soil deodorized after lying in heap for 8 or 9 months.

90. The following are the details of the experiment :—

——	Manured Plot.	Unmanured Plot.
	Yellow Cholum.	
General nature of soil ...	A poor light sandy soil	A poor light sandy soil.
Area of land sown	Half an acre	Half an acre.
Cultivation of soil before sowing.	Twice ploughed and harrowed ...	Twice ploughed and harrowed.
Kind and quantity of manure used.	20 cart loads of night-soil	None.
Pounds of seed sown ...	35 pounds	35 pounds.

—	Manured Plot.		Unmanured Plot.	
	Yellow Cholum.			
Date of sowing	14th October		14th October.	
Date of appearance of plants above ground	19th October		19th October.	
Cultivation during growth of crop.	Once bullock hoed and hand hoed.		Once bullock hoed and hand hoed.	
Number of inches of rainfall and number of wet days during growth of crop	Wet days. 26	Inches. 21·29	Wet days. 26	Inches. 21·29
Date when crop harvested ...	1st February 1876		16th February 1876.	
	Yield of plot.	Yield per acre.	Yield of plot.	Yield per acre.
Weight of grain when fit for market	186 pounds ...	372 pounds ...	193 pounds ...	386 pounds.
	Yield of plot.	Yield per acre.	Yield of plot.	Yield per acre.
Weight of straw when dry ...	3,108 pounds ...	6,216 pounds ...	2,198 pounds ...	4,396 pounds.

91. The plants produced on the manured plot were larger and better developed than those on the other plot; but, there appeared to be fewer of them.

92. On the manured plot the yield of straw was nearly 50 per cent. greater than on the unmanured plot; but, the yield of grain was slightly the heaviest on the unmanured plot.

93. I think it probable that many of the young seedlings were killed by the heavy dressing of manure, from its soluble salts being brought into too great activity by the heavy rains that fell after the experiment began.

94. Other experiments will be made with village night-soil.

GREEN MANURING.

95. The horse gram (*dolichus uniflorus*) is well suited for culture on sandy soils, for ploughing-in as, a green-manure.

96. Last dry season, we raised crops that yielded from 2,000 to 3,000 lbs. of plant per acre in a period of about 12 weeks, during which the rainfall did not amount to 1 inch.

97. In the neighbourhood around Madras, the "summer crops" on dry sandy land, are exceedingly precarious; on the average, we have not more than one year in four, in which, crops sown in June or July, yield returns that repay the expenses of cultivation. I think therefore that instead of attempting to grow "summer crops" such as, gingelly, cumboo, &c., except, on a small scale, on choice land, that, the wisest course after removing the "cold weather crop," would be, to clean the soil thoroughly and, then to sow it with horse-gram, for ploughing-in. These sowings would, in the space of three months, or so, yield per acre from 2,000 to 3,000 pounds of plant which, if ploughed-in, would prepare the soil, admirably, for the succeeding "cold weather crops." The green plant of horse-gram when ploughed-in improves the chemical and physical state of the soil.

Yield of gram plant in a dry season.

Gram a good summer crop for green manuring purposes.

98. When the seed, is drilled in lines, the land can be hoed, by cattle, or, by hand, during the growth of the crop, in this way, the weeds can be kept down, and, the soil maintained in a loose friable condition.

FARM-YARD MANURE AND THE ASHES OF CATTLE DUNG AS FERTILIZERS.

99. In my last Annual Report at paragraph 123, I recorded the results of an experiment made, to determine the weight of farm-yard manure produced by two cattle and, the weight of ashes, made from the dung of two other cattle which were similarly fed and worked, during a period of two months. The following observations refer to another experiment of a somewhat similar kind.

100. The manure collecting part of the experiment began on the 1st of January and terminated on the 31st of March, during which time there was no rain whatever. Four working bullocks were used in the experiment, all were similarly fed and worked, and, at night, all were confined in loose-boxes.

101. The loose-box in which two of the animals were confined was bedded with straw in the usual way; 105 pounds of paddy straw was used for the purpose; and, to this, there would be added, during the experiment, about ten pounds daily, in the shape of waste fodder thrown down and trodden-in by the cattle. The whole of the solid and liquid excreta of these animals was mixed with the bedding; the manure, thus made, was not removed until the termination of the experiment, when the total weight was found to be 3,150 pounds.

102. The other two bullocks had no bedding, their solid excreta was regularly collected and removed; the urine was absorbed by the soil and was lost. The whole of the solid excreta was made into bratties, in the usual way, these, after being thoroughly dried, were burned; the ashes yielded weighed 131 pounds.

103. The result, thus far, was 3,150 pounds of farm-yard manure, made by two bullocks during three months, and, 131 pounds of ashes, obtained from the solid excreta of other two bullocks, during a similar period.

104. A piece of land measuring 2,427 square yards which, had previously been ploughed, was divided into three equal sized plots : to one plot, the farm-yard manure 3,150 pounds was applied ; to another plot the ashes, 131 pounds, were applied ; and, the other plot was unmanured. The cultivation details were as follows :—

—	Plot No. 1.		Plot No. 2.		Plot No. 3.	
General nature of soil ...	Sandy loam		Sandy loam		Sandy loam.	
Area of land sown	809 square yards ...		809 square yards ...		809 square yards.	
Cultivation of soil before sowing.	Ploughed & ridged ...		Ploughed & ridged ...		Ploughed & ridged.	
Kind and quantity of manure used.	3,150 lbs. of farm-yard manure.		131 lbs. of ashes of bratties.		Not manured.	
Pounds of seed sown ...	20 lbs of yellow cholum.		20 lbs. of yellow cholum.		20 lbs. of yellow cholum.	
Date of sowing	8th April 1876		8th April 1876 ...		8th April 1876.	
Do. of appearance of plants above ground.	13th April 1876 ...		13th April 1876 ...		13th April 1876.	
Cultivation during growth of crop.	Hand hoed		Hand hoed		Hand hoed.	
	Wet days.	Inches.	Wet days.	Inches.	Wet days.	Inches.
Number of inches of rain-fall and number of wet days recorded during growth of crop	25	8·83	25	8·83	25	8·83
Date of first cutting ...	22nd June 1876.		23rd June 1876.		24th June 1876.	
	Per plot.	Per acre.	Per plot.	Per acre.	Per plot.	Per acre.
Weight of fodder from first cutting	4,058 lbs.	10·826 tons.	4,368 lbs.	11·684 tons.	3,140 lbs.	8·578 tons.
Date of second cutting ...	23rd August 1876.		23rd August 1876.		23rd August 1876.	
	Per plot.	Per acre.	Per plot.	Per acre.	Per plot.	Per acre.
Weight of fodder from second cutting	1,680 lbs.	4·4825 tons.	1,176 lbs.	3·037 tons.	896 lbs.	2·197 tons.
Weight of fodder from first and second cuttings.	5,738 „	15·3085 „	5,544 „	14·721 „	4,036 „	10·775 „

105. Unfortunately, we were unable to carry the experiment further ; the land, on which the crops were growing, being required to facilitate the carrying out of certain estate improvements.

Ashes gave a quick return ; the fold-yard manure acted more slowly.

106. It will be observed that, the first cutting of fodder obtained from the plot manured with the ashes, was heavier, than that which was obtained from the plot manured with farm-yard manure ; but, the second crop, was 50 per cent. lighter on the ash manured land than that on the land manured with farm-yard manure. Had the experiment been continued further, I am certain that the farm-yard manure would have shown in a decisive manner its superiority. At the beginning of the experiment the ashes

yielded their full effect; while, the farm-yard manure, acted more slowly. Of course, it would have been better not to have irrigated the plots at all; but the experiment was made in the hot season when water is required for germinating the seed. The experiment was also defective, as a comparative one, from the ash-manured ground not having had applied to it the equivalent of the ash, of the straw used in the manufacture of the farm-yard manure.

CROPS.

GERMINATION OF SEEDS.

107. The following experiments were made by Mr. Schiffmayer to test the powers of seeds to germinate when sown at different depths in the soil :—

When counted.	Maize.						New Orleans Cotton.						Horse Gram.						Wheat.					
	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.	1 Inch.	2 Inches.	3 Inches.	4 Inches.	5 Inches.	6 Inches.
	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.
1875.																								
23rd August ...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...
24th do. ...	...	...	...	...	...	...	4	...	...	...	...	...	54	4	...	...	...	...	...	...	...	...	...	...
25th do. ...	1	1	...	...	...	...	27	1	...	...	...	...	69	60	35	6	6	6	24	...	...	...	...	...
26th do. ...	8	10	10	2	2	...	37	4	...	...	...	...	70	62	42	15	11	10	70	...	...	...	...	...
27th do. ...	19	40	26	10	8	1	44	18	3	4	...	...	72	68	57	24	21	10	75	40	6	4	1	...
28th do. ...	19	41	29	21	8	1	44	26	16	8	1	1	70	70	57	29	29	13	81	62	21	17	5	2
30th do. ...	23	44	37	27	11	1	50	37	18	9	5	1	73	73	61	39	37	15	91	70	41	19	15	3
31st do. ...	23	44	37	27	11	1	50	37	18	9	5	1	73	73	61	40	38	17	91	70	41	20	15	6
1st September ...	23	44	37	27	11	1	50	37	18	10	5	1	73	73	61	40	38	17	91	70	41	20	15	5
2nd do. ...	23	44	37	27	11	1	50	37	18	10	5	1	74	75	61	40	38	17	91	70	41	20	15	5
3rd do. ...	21	41	34	27	11	1	48	34	17	10	5	1	69	72	58	38	33	16	74	68	41	20	15	5

108. The soil, was dug to the depth of one foot and, was manured liberally with fold-yard manure and ashes. The seed was sown on the 21st of August, at the different depths shown in the foregoing statement. One hundred grains of each variety were sown, except of the wheat, of which, 200 grains were sown. Some of the maize seeds were destroyed by ants, hence, the small number of maize plants. The wheat, did not thrive, many plants perished, evidently from the unsuitability of the season. The beds, were watered every third day. The ground, was hoed on the 2nd of September, and again on the 24th of September.

109. The seed was tested before being sown with the following results :—

Maize, 75 per cent. of vital seed.
New Orleans cotton, 75 do. do.
Horse gram, 80 do. do.
Wheat, 50 do. do.

110. It will be observed that the maize seed, gave the best results when sown at two inches in depth. When maize is sown at anything greater than 4 inches in depth, the crop, from deficiency of plants, must be a failure. It will be noted that when the seed was sown 2 inches in depth, most of the plants appeared above ground five days after the seed was sown. With the cotton seed, the best results both as regards number of plants and early appearance above ground, were obtained when the seed was deposited only one inch in depth and it will be observed

that the cotton seed is even less able than the maize seed, to produce plants when sown at depths greater than three inches. Of the seeds tested, horse gram appears to be the least affected by differences in the depth at which it is sown; it is remarkable for its rapidity of germination and equally so for its ability to produce plants when sown at a considerable depth in the soil. With wheat, the best results were obtained with sowings at one inch in depth.

111. From these experiments it would appear that most plants are obtained from seed sown at depths of from one to two inches. It must, however, be remembered that, the ground on which the seed was sown was watered every third day and that, it was previously dug over to a depth of one foot, and, was liberally manured; under these conditions it may be wise to sow shallow but, in actual practice, I think, that the best results will be obtained with sowings at from two to three inches in depth; as, the favorable conditions just noticed can seldom be secured to the same extent, in the field.

112. These experiments prove, how fallacious are calculations based on the relation the yield of a crop bears to the quantity of seed sown.

INDIGO SEED.

113. In December last, a gentleman, largely interested in the cultivation of indigo, wrote to me as follows :—

"The indigo plant, produced from the seed hitherto sown by us, viz., the seed raised in the Godavery District, chiefly on islands in the Godavery, is very much inferior to the indigo plant raised from seed imported from Bengal and, the North-West Provinces; and though, the latter, costs three times as much as the Godavery seed, I am importing some."

He forwarded a sample of the Bengal seed and a sample of the Godavery seed. These seeds were subjected to a careful examination; first, the specific gravity of each was determined, these were found to be as follows;—

Bengal indigo seed, specific gravity	1·333
Godavery do. do.	1·270

114. The vitality of the seeds of the two samples was next determined by placing the seeds on blotting paper and keeping them damp in the usual way. The following are the results ;—

—	Bengal Seed per cent.	Godavery Seed per cent.
24 hours after the experiment began, there had germinated ...	85	30
48 hours after the experiment began, there had germinated	90	61
72 hours after the experiment began, there had germinated	96	79

THE BAMBOO, AS A PAPER-MAKING MATERIAL.

115. Mr. Thomas Routledge, of Sunderland, England, directed my attention to the bamboo of this part of India as, being worth special culture, for the production of a paper-making material.

116. The bamboo has long been employed by the Chinese and Japanese for paper-making purposes; but, it is only since the discovery of Mr. Routledge's new process of treatment, that it has been found possible in Europe to produce good paper from bamboo fibre at a moderate cost.

Bamboo grows wild in many parts of Madras Presidency.

117. There are in this Presidency large areas of land on which the bamboo grows wild; but, these tracts of country are generally too distant from the coast, to admit of the canes being transported and shipped at a moderate cost; while, as these bamboo jungles are frequently very feverish, there is but little probability that a factory for preparing paper-stock, could be established on the spot and worked with economy.

The common bamboo of the plains not suited for paper fibre.

118. The bamboo (*Bamboosa Arundanacea*) which is found growing singly and in clumps, in so many places in the eastern part of this Presidency, is not suited for cultivation in the way Mr. Routledge advocates; it is too bushy in growth, has too many lateral branches, and is armed with long sharp formidable spines. I forwarded to Mr. Routledge, at his request, a bale of stems and branches of this bamboo, taken from a plant about five years' old which, was growing under ordinary conditions; regarding these samples he writes:—

"The spines, I see clearly, are awkward to deal with, and if bamboo has to be cultivated at all near you it would appear that, owing to these spines, and the bushy habit of the variety, another species should be selected in preference. The stems sent are wholly unsuited for my purpose; they are far *too woody*, whether from age or whether from the nature of the plant, the dryness of the climate, or other reasons I am unable to determine. * * * * * * * I am more and more convinced that it is hopeless to grow bamboo for my purpose, that is, to get abundant crops of young succulent stems in the herbaceous stage, without abundant and almost perennial moisture of soil with good drainage; and if this cannot be secured naturally it must be provided artificially by irrigation as and when required. * * * * * * * But water, the bamboo must have, not merely to promote rapid and prolific growth, but to ensure soft silky and delicate fibre. Hard, woody, silica coated stems are unsuitable for paper-making or textile purposes."

119. The canes sent to England were fair average specimens of those procurable in this part of the Presidency. The *Bamboosa Arundanacea* is capable of withstanding the effects of a long drought, from its slow growth; while, from this slowness of growth, it produces hard canes that are well suited for use in roofing huts and other similar purposes; but, these qualities are, in the estimation of the paper manufacturer, so many defects in this bamboo, for, he requires a soft-wooded, succulent stem.

120. It is clear, therefore, as Mr. Routledge says, that if we would on this side of India, produce bamboo canes, for manufacture into paper-stock, we must cultivate a species of bamboo that is characterized by rapidity of growth, length, and straightness of stem, and freedom from lateral branches and spines.

121. The climate of the eastern side of the Presidency is not, I think, suited for the successful culture of such a variety of bamboo without the aid of irrigation water; but, so aided, I see no practical reason why, a plantation formed, as

described by Mr. Routledge, should not be worked successfully where there is suitable land and labor available.

Bamboo plantations necessary.

122. To ensure a regular and continuous supply of canes, under economical conditions, Mr. Routledge recommends that, bamboo plantations should be established and worked in the same way as are sugar-cane plantations; and that in connection with these Plantations a Central Factory should be established for the manufacture of paper-stock, in which shape, he would export the bamboo fibre; he recommends, that these plantations should be laid out, and irrigated, in the way practised in cultivating the sugar-cane in Egypt, Spain, and other countries.

Cuttings yield quicker returns than seed.

123. Mr. Routledge advises that, in starting a bamboo plantation, root offsets and stem cuttings of the bamboo should be planted, in preference, to sowing the bamboo seed, as, the former will begin to yield cuttings two or three years sooner than the plants raised from seed.

124. Propagation of the bamboo by stem cuttings, is unknown in this part of India, though, the sugar-cane is always propagated in this way. In a letter of the 15th of November last, in reference to an experiment in bamboo culture being made in Jamaica, Mr. Routledge favoured me with the following extract from a report, dated the 30th of September :—

"The stem cuttings planted on the 29th of July are two feet high and from ½ to ¾ of an inch in diameter, but the root cuttings are from four to five feet high, and, from ½ to 1 inch in diameter. The cuttings from stems planted Chinese fashion, viz., making a hole in the piece of stem between the knots, filling with water, and then lightly covering with earth, does well at first, but always harbours ants; if instead of water the stem had been filled with very damp soil it would nourish the roots and assist in the decomposition of the stem while keeping out the ants."

Experiment with stem cuttings.

125. To ascertain whether the *Bambosa Arundanacea* could be propagated by stem cuttings, I had a small experiment made with cuttings, taken from various parts of the stem, both of old wood and young wood, and had some of these cuttings planted vertically and others laid horizontally in the soil. The soil, after being planted, was kept in a fair moist condition by frequent irrigation. The cuttings threw out numerous and vigorous shoots which, grew to a height of four feet when, they began to wither at their tips, and continued to do so right down to the main stem. The cuttings, were not removed, and, theground was frequently watered, but, no fresh shoots appeared; when the stem cuttings were raised out of the ground they were found to be almost as fresh and sound as when planted. I reported this result to Mr. Routledge, and in a recent letter he writes :

"I fancy your failure has arisen mainly, if not entirely, from lack of moisture, as your experiment has been corroborated by others made in Jamaica and in Ceylon."

126. I agree with Mr. Routledge in thinking that the chief cause of failure was lack of moisture, not in the soil however, but *in the air*. The weather, during the experiment, was excessively hot and dry and, the sky clear and bright. I have noticed when bamboos are cut down during the hot dry season, that the shoots

which spring up immediately from the roots, frequently die off, on reaching a length of three or four feet, in the same way as did the shoots from the stem cuttings in the experiment.

PRICKLY COMFREY (*Symphytum Asperrimum*).

127. This plant has attracted a considerable amount of attention during the past few months, and, its introduction into India has been the subject of many sensational articles in the newspapers. The assertion, so frequently made, that it is suited for culture in all parts of India is simply absurd; it would be no more ridiculous to assert that because the vine thrives in Southern France it can be grown with success, in all parts of Europe. That the *Symphytum Asperrimum* can be grown with success in some parts of India I am not inclined to dispute, but, a glance at the conditions mentioned by its advocates, as necessary for the successful culture of prickly comfrey will show how very limited must be the area of land in this country that will afford the conditions, even, if favorable climatical conditions can be secured. For instance, "it likes *moist boggy* places," "it needs deep loamy earth," "the roots will tap down eight feet in *open soil* to moisture, &c., &c."

It needs good deep moist earth.

128. The assertion, that the prickly comfrey will grow and produce good results on any soil, is altogether unsupported by evidence; perhaps, the best work, though now rather old, on matters pertaining to agriculture is "Morton's Cyclopœdia of Agriculture," and, in its article on comfreys we read :—

"It, common comfrey, has, however, fallen into disuse, as well as the two exotic species *S. Asperrimum* and *S. Echinatum*, both which are more productive than our wild plant. The comfreys are of little value, in fact, except in *good deep soil*."

Long known to British farmers.

129. The *S. Asperrimum* has been known to British Agriculturists for more than 40 years, and it has during these years occasionally attracted attention, but it never established itself in the good opinion of the British farmer. Dr. Voelcker, F.R.S., drew attention to the composition and nutritive value of the prickly comfrey, in a paper, published in volume 7, second series, of the Journal of the Royal Agricultural Society of England, from which I, take the following extracts :—

"The prickly comfrey (symphytum asperrimum) is a native of the Caucasus, whence it was introduced into England, in 1811, as an ornamental plant, by Messrs. Loddige, of Hackney. It is perfectly hardy in Great Britain, a rapid grower, and in moderately good soil reaches a great size; and even in poor soils grows over two feet high. It is a perennial plant, with fine reddish-blue flowers, and as it may be cut down three or four times in one season, it produces an abundance of succulent green food, which is said to be particularly useful for dairy-cows.

"It is conveniently propagated by divisions of the root; the root may be cut into small pieces, as the smallest bit will produce a plant. The best time for planting the root-cuttings is February or the beginning of March; on good soils it should be planted in rows 2 to 2½ feet apart and 15 to 18 inches apart in the rows. If the plantation is made early in the year and the cuttings strike root and get well established before genial spring weather sets in, it will yield two

good cuttings the first season, and in the succeeding years, if it is kept fairly clean and occasionally manured, it will give three or four cuttings, furnishing an abundance of green food from April to October.

"The prickly comfrey, although first introduced into England, has not much engaged the attention of English agriculturists; but it appears to be extensively cultivated in several parts of Ireland. It was extensively cultivated by the late Bishop of Kildare in a field at Glasnevim, where the plant is still found, growing up as a persistent weed in spite of every attempt to eradicate it. Many gentlemen after the example of the Bishop of Kildare, who was a first-rate dairy-farmer, are reported to cultivate it in their villa or suburban farms around Dublin, and find it very useful food for their dairy stock.

"At first cattle do not like it much on account of the prickly character of its leaves; but they soon get accustomed to it, and are said to do well upon the food.

"Its ordinary produce has been estimated by practical farmers at 30 tons per acre; but in experiments made in Ireland on Carnew Castle Farm on a considerable scale the produce is reported to have amounted to 82 tons per Irish acre in three separate cuttings,—of 28½ tons in the middle of April, 31 tons in the middle of July, and 22½ tons in the middle of September.

"The following figures express the detailed composition of prickly comfrey in its natural state:—

	Per Cent.
Water	90·66
Oil and chlorophyll	·20
* Soluble albuminous compounds	1·10
† Insoluble albuminous compounds	1·62
Gum, mucilage, and a little sugar	1·28
Woody fibre (cellulose)	3·30
Mineral saline matters, soluble in water	1·25
Mineral matters, insoluble in water	·59
	100·00
* Containing nitrogen	·175
† Do. do.	·259

"In comparison with other similar food, I may state that comfrey has about the same feeding value as green mustard, or mangold, or turnip-tops, or Italian rye-grass grown on irrigated land."

130. The yield mentioned by Dr. Voelcker is certainly large; it must, however, be remembered that, he refers to the Irish acre, which is, about one-third greater than the Statute acre; deducting, therefore, one-third from the total yield of the three cuttings, the return, per Statute acre, is about 55 tons. The prickly comfrey, it must be remembered occupies the ground a long time before it yields a cutting, while it is a very expensive crop to establish. We have, in this country, crops that will, under favorable circumstances, produce very heavily; amongst these, is the sugar-cane which, in a year, if treated as a fodder plant, will produce under fairly good conditions from 70 to 80 tons of excellent fodder. In my report for the year ending 31st of March 1873, I referred to a crop which, in one cutting, gave a yield amounting to nearly 60 tons, per acre; and this, was produced on a soil of a very ordinary character. Again, Hurialleé grass (*cynodon dactylon*) has been known, to yield, under irrigation, during a year, as much as 40 tons of green grass.

We have, on the Sydapet Experimental Farm, with cholum (*sorghum vulgare*) under occasional irrigation produced, in one cutting, as much as 19 tons of excellent fodder, per acre, in a period of less than five months; with Shamay (*panicum miliare*) we have under similar conditions obtained as much as 21 tons of fodder, per acre, in about the same period; and, under dry cultivation, we have with Chinese sugar-cane (*sorghum saccharatum*) produced as much as 11 tons of dry *fodder*, equal to about 15 tons of green fodder, per acre, in a period not longer than 4½ months. There are several other crops cultivated in this country that, will produce large returns of excellent fodder, when cultivated under proper conditions.

131. We are then not, so destitute, in this country, of plants suited for raising fodder nevertheless, it would be a decided gain, to add to the list of our fodder crops the prickly comfrey if, only one-half that has been said in its praise, is true. We cannot hope to see it growing successfully in the plains of Southern India but, on the Nilgiris, Shevaroys, in Wynaad, Coorg and other hill tracts of this Presidency, as well as, on the higher table-lands of Mysore, the prickly comfrey, might be expected to produce good results.

CROPS.

PLANTAINS.

132. In August 1872, 560 plantain sets, were planted on a piece of ground measuring half an acre. The plot was gradually increased as plants were available. On the 21st of October 1873 there were in all 1,250 plants, and, on the 31st of March following the number was 1,990. On the 5th of May 1874, 718 plants in full bearing were destroyed by the cyclone which then broke over this district thus, leaving only 1,272 plants; most of which were seriously injured. The plants broken down, during the cyclone, were removed and, 700 young plants were put in their places. During 1874 and 1875, the plot was still further increased as plants were available; at the end of March 1876, the number of plants on the ground was 3,530 of which, 156 were young plants substituted for 156 plants which, when in full bearing, were destroyed by a storm, in June 1875.

133. In May 1876, the land, on which these plantains were growing, being needed for other purposes, the experiment was closed. The produce of the plot was, altogether 1,776 bunches of plantain fruit, which, with leaves, &c., realized Rupees 375-7-10; valuing the plants on the ground, at the close of the experiment, at Rupees 100, the total value of the produce would amount to Rupees 475-7-10.

134. The return would have been much larger, had not the cyclone in 1874, and, the storm, in June 1875, committed so much damage. Valuing the trees actually broken down, at these times, at 4 Annas each, which price, had been offered for them, the loss, was upwards of Rupees 200, without taking into account the damage sustained by the plants which, were left standing.

135. The area of ground actually cropped would be in 1875 and in 1876, 3 acres; in 1874, 1¾ acres; in 1873, 1 acre; and in 1872, ½ an acre; and, for these 6¼ acres rent would be chargeable for one year. The expenditure was as follows:—

	RS.	A.	P.
Cost of plantain plants	51	7	7
„ of pitting, planting, and manuring	60	7	0
„ of manure	53	5	0
„ of watering	172	2	0
„ of tillage, weeding, watching, &c.	127	1	0
	464	6	7

136. Nearly two-fifths of the entire expenditure was for watering the plants, as the water had to be raised from a depth of 18 feet; an expenditure which, represents a charge of about 28 Rupees per annum, per acre cropped. In favorable situations, where water can be obtained by gravitation, or, is only to be raised to a moderate height, the charge for water and watering would be very small.

137. The manure used, was almost entirely compost manure, made of the blood refuse of the slaughter-house, and ashes. The effects produced by this compost were most satisfactory, the bunches of fruit were large and, the fruit was well flavored.

Large yield of land under plantain crop.

138. Though, the soil was very sandy it produced, under the plantain, a very heavy crop. Ten plantain trees, of fair average size, were found to weigh 994 lbs. or, about 99 lbs. each, and as, these were planted at distances of 6 feet apart, there would be 1,210 trees per acre; equal to, about, 53 tons weight of plants per acre.

BRINJALS (*Solanum Melongena*).

139. This crop, which is cultivated to some extent in many parts of Southern India, was grown experimentally on the Sydapet Farm last year. As I have not in any previous Annual Report referred to this crop, I record the following results. The cost, in each instance, is the actual cost, as taken from the Farm cultivation Book:—

PLOT I.

Area of plot	1 Acre.
Date of planting	11th March 1875.
Date of harvesting	May 15th to Oct. 10th.

Cultivation Expenses.

	RS.	A.	P.
Seedlings; value of	1	8	0
Manure; 600 lbs. of oil-cake at 100 lbs. per 1 Rupee, and, 6 loads of farm manure at 12 Annas per load	10	8	0
Cattle labor; in ploughing and working the land 6½ pairs of cattle, with drivers, at 12 Annas per day	4	14	0
Watering; 14 waterings at 1 Rupee each	14	0	0
Manual labor; planting seedlings in the field, spreading manure, &c., 11 men, at 3 Annas per day	2	1	0
Hand-hoeing and digging during growth of the crop; 43 men at 3 Annas, 5 women at 2 Annas, and 2 boys at 1½ Annas per day ...	8	14	0
	41	13	0

As, the effect of the manure would operate over, at the least, three years, two-thirds of its cost must be deducted, thus reducing the cultivation expenses to Rupees 34-13-0. The plants, began to bear in May and, continued to bear until the end of October, during this period the total weight of fruit gathered was 3,168 lbs. which, was sold, in the field, at an average of 7½ pies per viss, realizing Rupees 41-4-0.

PLOT II.

Area of plot	2,068 square yards.
Date of planting	20th April 1875.
Date of harvesting	June 7th to Nov. 9th.

Cultivation Expenses.

	RS.	A.	P.
Ploughing	3	0	0
Manuring and planting	2	14	0
Watering	11	0	0
Hoeing	1	12	0
Manure, 10 loads of farm-yard manure	5	0	0
	23	10	0
The crop was sold in the field for	45	1	6

RHEEA (*Boehmeria nivea*).

140. In November last, 100 roots of the rheea plant, were received from the Superintendent of the Botanical Gardens, Saharanpore, North-West Provinces. The roots, were much out of rcondition on eaching Sydapet, from the length of time (a week) occupied in transit. They were planted out at once, a considerable number of them grew and produced healthy plants but, during the hot season the leaves of most of the plants became so bleached and discolored, apparently from the high temperature at the time, it was deemed necessary to remove the plants to a plot of ground somewhat more shaded from the sun. The change was beneficial, the leaves assumed a healthy green color. A number of the plants were forwarded to the Collector of Coimbatore who, intends making some experiments with rheea. I fear that, there is but little probability, at present, of the rheea plant being cultivated successfully in this part of India, even, in localities where favorable climatical conditions can be met with, for, the plant requires, for its healthy growth, a very large quantity of potash and phospheric acid and, these mineral foods are now found in exceedingly small quantities in our ordinary arable soils, and ryots never apply manure that restores either.

High temperature injurious.

Needs a good soil.

GROUND-NUTS (*Arachis hypogea*).

141. The ground-nut is not cultivated to a great extent in this country but, there are a few localities in which the crop occupies a considerable area of ground. It requires a porous healthy soil, rich in potash, lime, &c. As generally cultivated

it is a very exhausting crop, and frequently repeated, rapidly reduces the fertility of a soil; however, if the cake, made from the crushed nuts, in extracting the oil, was given to the live stock on the Farm on which the nuts were raised, there would be but a small loss of fertilizing matters. But usually, the ryot sells the whole of the nuts he produces; and never gets back the cake for feeding his stock. The result of this is, that the soils, on which the ground-nut is cultivated, are becoming poorer and poorer every year, the fertilizing matters which, they lose, being turned to good account in the coffee estates of this country and Ceylon; and, in England and France to which countries the ground-nut is now largely exported.

Lime needed.

142. On two, or three, occasions small plots on the Experimental Farm were planted with ground-nuts but, the results obtained were unsatisfactory; there was always an abundance of leaf and stem but, the yield of nuts was exceedingly small. I attribute this to the absence of lime in the soils of this farm. A small experiment is being made to test whether when lime is added to the soil the plant will produce more abundantly.

143. The best manure, that could be used for this crop would be the dung of animals that have been fed on ground-nut cake; but, this would not return to the soil all the manural matters removed by the crop; the husks of the nuts, separated in shelling, should also be returned to the soil for, they are rich in fertilizing matters.

NEW ORLEANS COTTON.

144. New Orleans cotton, has been grown on this farm, with a fair amount of success, during the past three or four years, though, the soils are naturally very poor. It was only by good tillage and by the judicious use of manure that fair results were obtained. A return, of 150 to 180 lbs. per acre of clean lint, in addition to a fair crop of maize, grown in alternate lines with the cotton plants, was repeatedly obtained.

Suitable for high culture.

145. This species of cotton, in some respects, is adapted for high cultivation in this part of India; under the influences of manure, indigenous varieties of cotton produce a great deal of wood and leaf but, the New Orleans species yields a liberal return, in lint, for any manure that is applied to it.

146. In its own country, the New Orleans plant comes much quicker to maturity than it does in this country; to some extent this is due to the different climatical conditions it has to encounter in the two countries, as, is shown in the following tables:—

Meteorology of the Cotton-producing Areas, in New Orleans, during the period in which Cotton is growing.

Months.	Maximum Temperature.	Minimum Temperature.	Rainfall.
			Inches.
April	83	46	3·75
May	92	61	1·90
June	91	73	2·30
July	95	72	6·00
August	92	75	5·40
September	88	66	1·30
October	85	54	0·30
November	82	38	6·55
December	74	25	8·45

Meteorology of the district around Madras, during the period in which Cotton is growing.

Months.	Maximum Temperature.	Minimum Temperature.	Rainfall.
September	99·4	72·4	4·78
October	96·3	70·4	12·66
November	90·6	67·5	18·08
December	87·8	63·9	4·91
January	87·2	61·4	0·09
February	91·3	64·4	1·31
March	95·1	65·1	0·47
April	101·1	72·7	0·76
May	105·2	74·4	2·50
June	104·0	74·7	2·08
July	102·4	74·2	4·35
August	99·2	73·5	4·42

147. It will be observed that, the temperature of Madras is much higher than the temperature of New Orleans; also that, in New Orleans the temperature in December sinks below the freezing point which, of course, puts a stop to all vegetation. In New Orleans, the producing capabilities of the cotton plant are therefore more concentrated, from the shorter season in which the plant bears. In Madras, on the other hand, we have no such complete cessation of vegetable energy, excepting, during an unusually long drought; thus, we have *no definite harvest time* for our cotton, a gathering being afforded, after every heavy fall of rain succeeded by bright hot weather.

148. From the causes just noticed we are put to a much greater expense in harvesting cotton than, the planter in New Orleans; he, seldom puts his people to gather until each can collect, in a day, from 40 to 50 pounds of seed-cotton; and, in eight or ten successive gatherings, he harvests his whole crop. We, are obliged frequently to harvest a gathering when, it is as much as a cooly can do to gather five pounds of seed-cotton in a day, and as, we may have probably twenty gatherings, at the least, to make in the year, the cost of harvesting the cotton is exceedingly heavy.

Cost of harvesting cotton expensive from no harvest season.

149. On this farm, we sow New Orleans cotton in the month of September; during the three following months its growth is rapid from the heavy rainfall of the monsoon but, there being but little rain during January, February, March and

April the growth of the plant during these months receives a serious check; in May, June and July, if the rainfall is favorable and the weather bright several fair gatherings of cotton are obtained but, it is seldom that the yield obtained by the end of July, is such, as to justify the removal of the plants, in clearing the ground for another crop; hence, the plants are generally allowed to stand on the land until, the end of September. In August, when the weather is bright with occasional showers, a considerable gathering of cotton is obtained which, makes the yield of the crop much more respectable than, would have been the case, had the cotton plants been cut down in July; but, there is a great deal of uncertainty attending the harvesting of cotton in August, for, if the weather is dull and cloudy as it sometimes is, the cotton boles do not burst freely and, become infested with insects which, greatly injure the quality of the lint; while, the lint is shorter than, in the early part of the season. And, a further objection to keeping the cotton plant on the land, so late in the season is, that the soil cannot be cleaned and prepared, in a satisfactory way, for the cold weather crop to follow.

Dull weather injurious to cotton at harvest time.

150. Some improvement might be effected, by sowing the cotton seed in August or, even in July, when the state of the weather admits, the plant would thus begin to bear in the beginning of December.

151. I will try an experiment with New Orleans cotton under occasional irrigation; by rendering the plant independent of the weather, it may be induced to alter its bearing season.

152. I see no prospect of any success attending the cultivation of New Orleans cotton plant, in this Presidency unless, under good cultivation; tillage and manure are indispensable.

Tillage and manure indispensable for New Orleans cotton plant.

153. It is much to be regretted that in most parts of this Presidency cotton land is never manured, crop after crop is removed without a particle of manure being applied to the soil. The fertility of cotton land, might be prolonged to an indefinite period, would the ryot but use the cotton seed in feeding his stock and, apply their dung to the soil which yielded the crop; but, he never thinks of so using the cotton seed except, to a very limited extent, and then, the manure is applied only to his garden crops. Cotton lint removes but little from the soil; the loss of fertilizing matters is due to the removal of the plant and seed. The plant is, in most instances, taken to the villages and used as fuel, but it is seldom that the ashes made, ever find their way back to the soil, on which the cotton plants were raised.

Cotton not an exhausting plant under good farming.

LIVE FENCES.

154. During my tour, in Coimbatore, I saw in the neighbourhood of Avenashy and, in some other places, some excellent fences which had been formed by planting cuttings of the branches of a thorny tree called in tamil, "Moolloo Kiloovay." The cuttings readily take root on being planted, and, at once form a fence.

155. I had a quantity of the branches of this shrub sent to Sydapet where they are now growing; from these, I hope next year to get enough cuttings to establish a fence which, in its turn, will provide cuttings for making other fences, and, in

this way, a new fence shrub will, I trust, be introduced into general use in this part of the Presidency.

156. During the same tour, I procured a quantity of the seed of a very thorny shrub, one of the acacias, which, I found growing on the dry almost sterile land between Mettapollium and Nellithoray. The shrub, is of a moderate height, is thickly covered with branches which, are armed with the most formidable thorns I ever saw.

157. We have recently established corkapilly fences, by planting in manured trenches the root cuttings from old corkapilly fences; the results, so far, have been all that could be desired; the stems root at once, and immediately begin to throw out branches. I have no doubt but that we will be able, under this system, to establish a useful fence in a period of less than six months. Under ordinary circumstances, corkapilly fences, started from seed, are of little use until two years old, and then only, when they have been attended with great care.

CROPS RAISED FROM IMPORTED SEED.

AUSTRALIAN SEEDS.

158. In September last we received from Australia, a small supply of agricultural seeds; these consisted of Chinese sugar-cane, planters' friend, maize, of three varieties, prairie grass, buffalo grass, osage orange, &c.

159. Most of these seeds were sown on the Experimental Farm, for producing seed for distribution. Some of the crops raised from them, were very good and, a large quantity of excellent seed was obtained.

160. The following, will afford information regarding the general results obtained with some of these Australian seeds:—

CHINESE SUGAR-CANE (*Sorghum Saccharatum*).

General nature of soil	Sandy loam.
Area of land sown	6,294 square yards.
Cultivation of soil before sowing	Three times ploughed, harrowed and ridged, and, again ridged by splitting the ridges over the manure.
Kind and quantity of manure used	35 cart loads of farm-yard manure, and 20 lbs. of guano spread uniformly in these furrows between the ridges.
Pounds of seed sown	14 pounds.
Date of sowing	7th of October.
Date of appearance of plants above ground ...	12th of October.
Cultivation during growth of crop	Twice hand hoed.
Number of inches of rainfall, and number of wet days recorded during growth of crop ...	27 wet days; 21·31 inches.
Date when crop harvested	20th of January 1876.
Weight of grain when fit for market	1,468 pounds.
Weight of straw when dry	11,648 pounds.

161. A yield, per acre, of 1,128 pounds of grain, and 8,969 pounds of straw is, a very satisfactory one. The grain, was quite as good as that received from

Australia. The crop was healthy throughout the whole period of growth; and was not irrigated.

162. However, it is not for the production of grain that, I recommend Chinese sugar-cane to the notice of farmers in this country; we, allowed the crop to produce grain, simply, because seed was required for distribution, but, in general cultivation the crop should be cut down when in flower, in order to secure the fodder in the best condition; only a few plants being allowed to produce seed in view to reproducing the crop.

163. The Chinese sugar-cane will yield 2 or 3 successive cuttings of fodder, under good cultivation when, occasionally watered, but it does not throw out so many fresh stems, as, do the cholums of this country after each cutting.

PLANTERS' FRIEND.

General nature of soil	Sandy loam.
Area of land sown	3,654 square yards.
Cultivation of soil before sowing	Twice ploughed, harrowed, and ridged, and again ridged by splitting the ridges over the manure.
Kind and quantity of manure used	24 cart loads of farm-yard manure.
Pounds of seed sown	10 pounds.
Date of sowing	16th of October.
Date of appearance of plants above ground ...	21st of October.
Cultivation during growth of crop	Once hoed by cattle, and twice hand hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	22 wet days; 19·57 inches.
Date when crop harvested	3rd of February 1876.
Weight of grain when fit for market	992 pounds.
Weight of straw when dry	5,040 pounds.

164. The yield, per acre, was thus 1,313 pounds of grain and, 6,675 pounds of straw.

165. Like the Chinese sugar-cane, the planters' friend is a fodder producer, and therefore, to obtain from it the largest quantity of nutritious fodder, it should be cut down when in flower. In the experiment, under notice, the object was, to obtain seed for distribution.

166. It will be observed that, the planters' friend produced a somewhat smaller return, of straw than did the Sorghum Saccharatum but, it yielded a larger quantity of grain. The crop was produced without the aid of irrigation water.

167. Some years ago I made a small experiment with planters' friend but, the results were not encouraging; the crop, occupied nearly six months in reaching maturity; in the experiment, just referred to the crop was scarcely four months on the ground.

MAIZE.

168. The varieties of maize imported were Early French, Early American, and Yellow Flint. The first, matured about twelve weeks after sowing, but produced very small cobs; this variety is, apparently, not suited for field culture. The other

two varieties grew very well and produced good average crops. The total quantity of seed sown was 46 pounds, and, the quantity of seed harvested was 1,900 pounds. No special experiments were made with the maize.

169. The following are the results of some ordinary sowings in which the maize seed was sown in lines, alternately with lines of cotton seed :—

MAIZE—EARLY AMERICAN.

General nature of soil	Sandy loam.
Area of land sown	2·83 Acres.
Cultivation of soil before sowing	Twice ploughed, harrowed, and ridged and, again ridged over the manure.
Kind and quantity of manure used	42 loads of farm-yard manure.
Pounds of seed sown	18 pounds.
Date of sowing	21st of September.
Cultivation during growth of crop	Twice hand hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	31 wet days ; 24·00 inches.
Date when crop harvested	29th of December.
Number of cobs	7,390.
Weight of straw when dry	5,824 pounds.

170. The foregoing, it must be remembered, is the produce only of half of the ground, the cotton crop occupying the other half.

MAIZE—YELLOW FLINT.

General nature of soil	Sandy loam.
Area of land sown	1½ acres.
Cultivation of soil before sowing	Ploughed, harrowed, and ridged.
Pounds of seed sown	19 pounds.
Date of sowng	22nd of September.
Date of appearance of plants above ground ...	25th of September.
Cultivation during growth of crop	Twice hand hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	31 wet days ; 24·00 inches.
Date when crop harvested	5th of January 1876.
Number of cobs	4,050.

171. The remarks, made with reference to the last experiment regarding the area of land actually cropped, apply equally to this.

PRAIRIE GRASS (*Bromus unioloides*).

172. A small area of land was sown with the seed of this grass, the general results were not more satisfactory than were those we obtained with Prairie Grass seed in former years. The seed germinated well and, produced healthy plants but, these all died down in the hot season. The prairie grass is highly esteemed in Australia, where it is said to thrive in the hottest seasons but, from my experience with it, at Sydapet, I do not think it is suited for the conditions generally met with in this part of India; besides, it is not a perennial grass, and, we already possess many annual fodder plants that yield heavily, under fair cultivation.

BUFFALO GRASS (*Stenotaphrum glabrum*).

173. A few roots of this grass were obtained from Australia: though they were sent in a box, without any special precautions having been taken in packing, most of them were alive on reaching Madras. As, these roots had been out of the ground for six or seven weeks, at the least, the fact of their surviving this treatment is, I think good evidence of the hardihood of the grass.

Great vitality.

174. The plants have thriven since being planted out and, are spreading over the ground, but the area yet planted is too small, to admit of any practical conclusions being arrived at regarding the suitability of the buffalo grass for general culture here.

175. The buffalo grass is very highly appreciated in Australia and in America. Dr. Schomburgh in a lecture, he recently delivered before an Australian audience, speaking of the buffalo grass said :—

"The buffalo grass (*Stenotaphrum glabrum*), is a native of the warmer countries of America, which I cannot sufficiently recommend. It is a perennial, and every farmer and squatter should not be without some of this valuable grass. It is a creeping grass like the couch or dub grass, and is capable of standing any drought. Its fattening qualities, I think, are not so great as the before mentioned grasses; but the cattle and sheep like it very much. It thrives well on a sandy soil, and is easily propagated from cuttings, as every little piece will grow, and after taking root it spreads very rapidly. It is also well adapted for binding river banks or sandy spots. It can advantageously be used for permanent pastures. The buffalo grass is entitled to a general introduction to our pasture. It is also very suitable for garden lawns. Every one who has visited Sydney no doubt has been struck with the fine lawns, especially those of the Botanic Gardens. Since the last two years I have used it also for this purpose instead of the couch grass. The buffalo grass keeps its verdant freshness winter and summer—a great contrast regarding the dullness of the color which the couch grass has during the winter. Notwithstanding, as already mentioned, that in appearance the buffalo grass seem to be coarse, cattle readily feed on it."

176. In his report for 1868, the Commissioner of Agriculture for the United States, thus refers buffalo grass ;—

"Mr. Harris Lewis exhibited samples of buffalo grass, he had found in Wisconsin which, he considered the most valuable he had seen for grazing. He found it growing over an area of 90,000 square miles."

177. Dr. George Bennett in a paper on Australian grasses published in 1873 says, regarding buffalo grass :—

"My friend, Mr. Charles Moore, has given me some information on the subject, which I will embody with my own observations. It would scarcely be possible to over-estimate the value of the buffalo grass in situations suited for its growth, but although introduced in this colony many years ago, it has not been spread by any means to that extent which its abundant yield and nutritive quality would have led one to expect—arising perhaps from its scarcely ever producing seed, in this colony, and the necessity, therefore, of planting it by offsets or cuttings, I can testify that no grass grown here can equal it, either for weight of herbage or for withstanding drought."

"It will grow on poor soils, in dry exposed situations, or under the shade of trees, where no other grasses will exist; but it is in low sheltered situations that this excellent grass flourishes

to the greatest advantage. When kept close eaten down, the thickly interwoven stems forms such a perfect mat as to overpower and destroy all other similar plants growing near. The cause of fertile seed not being produced in this colony is that this grass is dioecious, and we have only the female plants which, although having seeds in profusion, never attain maturity."

Grown in saline soils.

178. The buffalo grass is said to thrive in hardened alkaline saturated soils on which other grasses will scarcely exist: in this country we have a large area of such soils.

OSAGE ORANGE (*Maclura aurantiaca*).

179. We have raised a number of osage orange seedlings from seed, imported from Australia last year. They are healthy and appear to be thriving. It is hoped that this shrub can be acclimatized in this country as, it is well adapted for forming live fences, being bushy in habit of growth and, armed with long formidable spines.

180. The osage orange is greatly valued as a hedge plant in the Southern States of America and, in some parts of Australia. It is said that, the plant grows rapidly, thickens its branches freely when pruned, is not liable to be attacked by insects nor to be eaten by cattle and, will grow in any soil of ordinary fertility.

CROP STATISTICS.

181. The following statistics, refer to crops grown on the Sydapet Farm last year:—

SUMBA PADDY.

General nature of soil	A stiff loam.
Area of land sown	·88 acres.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	6 cart loads of yerkum and croton plants.
Date of planting	14th October 1875.
Date when harvested	10th February 1876.
Weight of grain when fit for market	Yield of plot 1,200 lbs. Yield, per acre, 1,364 lbs.

SUMBA PADDY.

General nature of soil	A stiff loam.
Area of land sown	·52 acres.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	6 cart loads of yerkum and croton plants.
Date of planting	29th September 1875.
Date when crop harvested	20th January 1876.
Weight of grain when fit for market	Yield of plot 1,127 lbs. Yield, per acre ·2,167 lbs.
Weight of straw when dry	Yield of plot 2,128 lbs. Yield, per acre, 4,092 lbs.

SUMBA PADDY.

General nature of soil	A stiff loam.
Area of land sown	·52 acres.
Cultivation of soil before sowing	Ploughed and levelled.

Kind and quantity of manure used	2 cart loads of yerkum and croton plants.
Date of planting	28th September 1875.
Date when harvested	19th January 1876.
Weight of grain when fit for market	Yield of plot 681 lbs. Yield, per acre, 1,310 lbs.
Weight of straw when dry	Yield of plot 1,568 lbs. Yield, per acre, 3,015 lbs.

SUMBA PADDY.

General nature of soil	Stiff loam.
Area of land sown	1 acre.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	8 cart loads of yerkum and croton plants.
Date of planting	21st October 1875.
Cultivation during growth of crop	Hoed.
Date when crop harvested	13th February 1876.
Weight of grain when fit for market	Yield of plot 2,090 lbs. Yield, per acre, 2,090 lbs.
Weight of straw when dry	Yield of plot 2,352 lbs. Yield, per acre, 2,352 lbs.

SUMBA PADDY.

General nature of soil	Stiff loam.
Area of land sown	·23 acres.
Cultivation of soil before sowing	Ploughed and levelled.
Date of planting	24th November 1875.
Date when crop harvested	6th March 1876.
Weight of grain when fit for market	Yield of plot 230 lbs. Yield, per acre, 1,000 lbs.
Weight of straw when dry	Yield of plot 448 lbs. Yield, per acre, 1,948 lbs.

CAR PADDY.

General nature of soil	Stiff loam.
Area of land sown	1,190 square yards.
Cultivation of soil before sowing	Ploughed and levelled.
Kind and quantity of manure used	8 loads of box manure.
Date of sowing	17th January 1876.
Date of appearance of plants above ground ...	21st January 1876.
Date when crop harvested	18th May 1876.
Weight of straw when dry	Yield of plot 1,436 lbs. Yield, per acre, 5,840 lbs.
Weight of grain when fit for market	Yield of plot 230 lbs. Yield, per acre, 935 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	2 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	60 lbs.

Date of sowing	29th November 1875.
Date of appearance of plants above ground ...	4th December 1875.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days during growth of crop	7 wet days, 2·99 inches.
Date when crop harvested	6th March 1876.
Weight of grain when fit for market	Yield of plot 1,130 lbs. Yield, per acre, 565 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	·62 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Kind and quantity of manure used	6 cart loads of farm-yard manure.
Pounds of seed sown	30 lbs.
Date of sowing	28th March 1876.
Date of appearance of plants above ground ...	31st March 1876.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	8 wet days, 3·87 inches.
Date when crop harvested	10th May to 25th June.
Weight of fodder	Yield of plot 6,240 lbs. Yield, per acre, 10,065 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	2·09 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Date of sowing	1st September 1875.
Date of appearance of plants above ground ...	6th September 1875.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days recorded during growth of crop ...	29 wet days, 25·27 inches.
Date when crop harvested	20th November to 4th December 1875.
Weight of fodder	Yield of plot 9,196 lbs. Yield, per acre, 4,400 lbs.

YELLOW CHOLUM (*Sorghum Vulgare*).

General nature of soil	Sandy loam.
Area of land sown	2,697 square yards.
Cultivation of soil before sowing	Ploughed and harrowed.
Cultivation during growth of crop	Hoed once.
Date when crop harvested	17th September to 16th November 1875.
Weight of fodder	Yield of plot 7,824 lbs. Yield, per acre, 14,041 lbs.

CUMBOO (*Penicillaria Spicata*).

General nature of soil	Sandy loam.
Area of land sown	1·02 acres.
Cultivation of soil before sowing	Ploughed and harrowed.

Cultivation during growth of crop	Hoed once.
Date when crop harvested	17th September to 16th November 1875.
Weight of fodder	Yield of plot 6,972 lbs. Yield, per acre, 6,835 lbs.

CUMBOO (*Penicillaria Spicata*).

General nature of soil	Sandy loam.
Area of land sown	4·11 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Kind and quantity of manure used	26 cart loads of ashes.
Pounds of seed sown	30 lbs.
Date of sowing	5th August 1875.
Date of appearance of plants above ground ...	10th August 1875.
Cultivation during growth of crop	Hoed and dug.
Number of inches of rainfall and number of wet days recorded during growth of crop.	19 wet days, 12·92 inches.
Date when crop harvested	From 29th September to 14th October 1875.
Weight of fodder	Yield of plot 10,248 lbs. Yield, per acre, 2,493 lbs.

SHAMAY (*Panicum Miliare*).

General nature of soil	Sandy loam.
Area of land sown	3·5 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Kind and quantity of manure used	5,000 lbs. of oil cake.
Pounds of seed sown	20 lbs.
Date of sowing	18th November 1875.
Date of appearance of plants above ground ...	23rd November 1875.
Cultivation during growth of crop	Hoed once.
Number of inches of rainfall and number of wet days recorded during growth of crop. ...	11 wet days, 8·12 inches.
Date when crop harvested	10th January 1876.
Weight of fodder	Yield of plot 5,952 lbs. Yield per acre, 1,701 lbs.

HORSE-GRAM (*Dolichos Uniflorus*).

General nature of soil	Sandy.
Area of land sown	6·25 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	157 lbs.
Date of sowing	30th December 1875.
Date of appearance of plants above ground ...	4th January 1876.
Cultivation during growth of crop	Hoed.
Number of inches of rainfall and number of wet days recorded during growth of crop.	7 wet days; 3·76 inches.
Date when crop harvested	From 2nd May to 17th June 1876.
Weight of fodder	Yield of plot 13,148 lbs. Yield, per acre, 2,104 lbs.

HORSE-GRAM (*Dolichos Uniflorus*).

General nature of soil	Sandy.
Area of land sown	5·02 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	136 lbs.
Date of sowing	24th December 1875.
Date of appearance of plants above ground ...	31st December 1875.
Cultivation during growth of crop	Hoed and dug.
Number of inches of rainfall and number of wet days recorded during growth of crop.	1 wet day ; ·81 inches.
Date when crop harvested	1st April to 1st May 1876.
Weight of fodder	Yield of plot 13,848 lbs. Yield, per acre, 2,759 lbs.

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HORSE-GRAM (*Dolichos Uniflorus*).

General nature of soil	Sandy.
Area of land sown	1·09 acres.
Cultivation of soil before sowing	Ploughed and harrowed.
Pounds of seed sown	15 lbs.
Date of sowing	6th August 1875.
Date of appearance of plants above ground ...	10th August 1875.
Cultivation during growth of crop	Hoed and dug.
Number of inches of rainfall and number of wet days during growth of crop	15 wet days ; 11·14 inches.
Date when crop harvested	22nd September to 7th October 1875.
Weight of fodder	Yield of plot 3,458 lbs. Yield, per acre, 3,172 lbs.

182. Though, the foregoing statistics, possess no scientific value, they are useful, in affording facts regarding the results of ordinary field practice. I have not attempted to show the cost of production or, the profit derived; but, I have given sufficient details, to enable any one interested, to calculate for himself the cost, or, the return, according to the rates prevalent, where he resides. This, I think is better than giving the financial results, for, the prices of agricultural produce and, the rates paid for labor, vary so greatly, in different parts of the Presidency.

183. The statistics, possess no scientific value because, they refer only to the history of the crop under notice and, take no account of the condition of the soil before the crop was sown. The soils, not being in an uniform condition when put under crop, the results cannot, of course, be compared together. This explains why, one crop, to which no manure was applied, produced as good results as another crop that was manured; the soil, to which no manure was given, having been manured, when bearing the previous crop. It is not sufficient to know the produce, obtained from a soil in a season, and, the expenditure in that season; we need also to know something of the previous history of the soil.

IMPLEMENTS AND MACHINES.

CHAIN PUMP.

184. The chain pump, referred to in a previous report as, being unsuited for use in deep wells when, worked by cattle, has been placed in a well in which the water is not far from the surface of the ground, and, has yielded very fair results as, will be seen, from the following :—

Rate Cattle travelled per hour.	Water raised.			Draught.
	Per hour.	Per hour.	Per day of 8 hours.	
Miles.	Cubic feet.	Gallons.	Gallons.	Hundred weight.
2·2819	231·33	1,441·7	11,533·6	1·5
2·5159	424·12	2,704·7	21,637·6	1·75
2·7955	683·31	4,258·4	34,067·2	1·75
3·0682	657·08	4,094·9	32,759·2	2

185. The draught registered, is only approximately correct, the Dynamometer used not showing accurately the fractions of a quarter of a hundred-weight. A pair of cattle were used in working the pump. The speed at which the cattle could be maintained throughout the day is about 2 miles, per hour, but a speed of about $2\frac{3}{4}$ miles per hour might be kept up, by working the cattle only for half a day at a yoking, that is, those employed in the morning's yoking to be put to other work in the afternoon, and, to be replaced at the lift by a pair of cattle which had been employed in the morning at other work.

DOUBLE MHOTE.

186. This water-lift continues to give good results. Several models of it have been sent to different parts of the Presidency. In Coimbatore Municipality, to which a model was sent, I recently saw 8 of these water-lifts working. Regarding the introduction of these water-lifts into the Coimbatore District, the Collector, in a letter to the Secretary to the Board of Revenue, No. 8, of the 10th of January 1876, para. 6, wrote :

"That interest has been awakened has been proved to me by numerous ryots having come to Coimbatore to inspect the improved water-lift which, I had constructed from a model furnished to me by Mr. Robertson, and, by their having evinced the most practical proof of its advantage, by adopting it."

Other accounts are equally as satisfactory thus, the Nawab of Masulipatam, in a letter of the 13th of June last wrote :

"The model of a "Double Mhote" which you kindly gave me is found very useful here. I have constructed the Mhote in my lands here and its work is going on now. Many of the Zemindars of the district are also desirous of introducing the practice of the Mouble Mhote, and I hope to see soon its usefulness throughout the district."

SINGLE BULLOCK CARTS.

187. When in Coimbatore, I saw some very useful single-bullock carts that belonged to the Municipality; at my request, the President, A Wedderburn, Esq., was good enough to have a specimen cart made up for experimental use on the Sydapet Farm. The cost of the cart at Coimbatore was only Rupees 35.

188. The following draught experiments were made with the Coimbatore cart, an ordinary country cart, and, a large box cart. The respective dead-weights of which were 547 lbs., 609 lbs., and 892 lbs.; the load of each cart was 100 large bricks weighing 650 lbs. The carts were drawn by coolies, in order to ensure regularity of draught; they were drawn over an ordinary road and over some arable land when loaded. Precautions were taken to ensure that the carts contended with similar conditions.

189. The following table shows the results obtained while the carts were being drawn over the road:—

Station where registered.	Coimbatore cart (single bullock).	Country cart (pair bullock).	Box cart (pair bullock).	Remarks.
	Loaded.	Loaded.	Loaded.	
	Pounds.	Pounds.	Pounds.	
0	84	112	196	Starting point.
1	56	56	56	
2	56	56	56	
3	56	56	56	
4	56	56	56	
5	56	56	56	
6	308	280	420	A drain crosses the road here.
7	168	140	224	
Average ...	103·6	101·5	140	

190. The next table, shows the results obtained, while the carts were being drawn over the arable ground.

Station where registered.	Coimbatore cart (single bullock).	Country cart (pair bullock).	Box cart (pair bullock).	
	Loaded.	Loaded.	Loaded.	
	Pounds.	Pounds.	Pounds.	
0	224	224	336	Starting point.
1	168	224	224	
2	168	168	224	
3	140	224	252	
4	168	224	224	
5	196	224	252	
6	196	224	224	
7	168	252	224	
8	168	196	252	
9	196	224	252	
10	224	196	224	
Average ...	183·2	216·3	244·3	

SWEEDISH PLOUGHS.

191. Arrangements have been made for procuring from Sweeden a few specimens of the iron ploughs exhibited at the Vienna Exhibition by Sweedish manufacturers. These ploughs were offered at very low prices and, they were referred to, in very favorable terms in the report of the Exhibition Commissioners.

IMPROVED WATER-CART.

192. A very handy water-cart was recently made in the Workshops. It consists of two zinc cans, hung between a pair of wheels. It is drawn by a single bullock. Each can contains 30 gallons; an iron hoop encircles each, at about half its height and, to this, the pivots are attached, by which the can is suspended. Being hung on pivots, the cans, when full of water, are always in an upright position, and the pivot hanging renders it easy to turn the cans over to be emptied. Being hung so close to the ground the cans can readily be filled by a boy.

IMPLEMENT WORKSHOPS.

193. The following implements and tools were supplied by the Workshops during the year to persons living in the provinces and districts mentioned :—

Province or District.	Combined Ploughs.	Iron Ploughs.	Iron Cultivators.	Maize Shellers.	Iron Harrows.	Drag Harrows.	Seed Barrows.	Winnowing Machines.	Scythes, &c.
Assam	...	2	...	1	1	...	...	...	...
N.-W. Provinces	1	...	...	...	...	1	1	...	...
Bombay	...	1	...	...	...	...	...	...	...
Chingleput	...	1	2	1	1	...	...	1	...
Mysore	4	4	1	...	1	1	...	...	...
Vizagapatam	...	...	1	...	1	...	...	...	...
Madras	2	1	...	...	...	...	...	...	...
Various	...	...	...	...	...	...	...	...	35
Total ...	7	9	4	2	4	2	1	1	35

194. In addition, a large quantity of work was done for the Sydapet Farms and, a number of models of water-lifts and implements, were made for distribution free to applicants.

195. The following are the details of income and expenditure during the past year :—

Income.

	Rs.	A.	P.
Advance from General Funds	219	4	11
Machines, &c.	1,036	2	6
Labor, materials, &c.	1,103	15	3
Total ...	2,359	6	8

Expenditure.

Plant	23	14	0
Cooly labor, &c.	1,188	10	7
Materials, &c.	1,081	14	1
Interest on Capital	65	0	0
Total ...	2,359	6	8

Implement Workshops' Balance Sheet on the 31st of March 1876.

LIABILITIES.

	RS.	A.	P.	RS.	A.	P.
Loan from General Funds for 1870-71				883	1	5
Do. do. 1871-72				213	1	2
Do. do. 1872-73				1,077	3	2
Do. do. 1875-76				219	4	11
Outstanding bills				93	4	0
Laborers' pay due for March 1876				105	2	10
				2,591	1	6
Deduct capital returned by excess of income over expenditure during 1873-74	213	10	5			
Deduct capitul returned by excess of income over expenditure during 1874-75	122	15	9	336	10	2
Total ...				2,254	7	4

ASSETS.

Buildings	419	15	3
Plant	327	11	6
Materials	147	4	6
New implements, machines, &c., in stock	461	0	0
Outstanding bills	312	1	8
Deficiency	586	6	5
Total ...	2,254	7	4

MODEL FARM.

196. This experiment was brought to a close in March last, our experience, during the past three years, having proved conclusively that, owing to the circumstances under which the experiment was being conducted, no useful information could be gained from it of the kind it was instituted to afford.

197. I have previously pointed out that, originally, the experiment was instituted to ascertain *what results could be obtained under an improved system of farming*, and that, before it had made much progress, it was found impossible to effect any thing of a satisfactory nature by improved tillage, &c., until, some very extensive and costly land improvements had first been carried out from the dilapidated, worn-out condition of the land; and that as it had been thought undesirable to alter the scope of the experiment, these land improvements, were carried into effect along with, the legitimate work of the experiment.

198. In my last Annual Report, at para. 153, I wrote:

"All things considered, it would perhaps be the fairest way of now dealing with the experiment, to consider the balance against the farm, as expenditure on behalf of the landlord to be dealt with, in the same way as with other expenditure on permanent improvements; to push on energetically to completion the whole of the contemplated improvements, and, at the end of the present year, if these improvements are then completed and the farm amply supplied with irrigation water, to have the whole of its soils valued by the Settlement Department, the rent, thus fixed, to be the ultimate rent of the farm *without any other charge.*"

However, the land, being needed for the stock-breeding experiment, elsewhere referred to, no other land, so favorably situated or, circumstanced, being available, it was accordingly, added to the Experimental Farm. In this way, a considerable outlay has been avoided. Under any circumstances, this experiment could not have proceeded much further, on its original basis for, a Railway line is to be cut right across the land on which it was being conducted and this would, of course, put a stop to its further progress.

199. Though, I have, repeatedly, in my Annual Reports, noticed the circumstances, under which this experiment begun, I must refer to the matter once more, it is so important, that the facts should be clearly understood;—In the official year 1867-68, the northern half of the Sydapet Farm Estate was rented out under short leases to native tenants; they cultivated only the land fit for ploughing, from the remainder, they obtained a very fluctuating income by collecting and selling, the fruit of the wild guava bushes with which much of the land was covered. In 1870-71 these tenants petitioned the Committee (by whom the Estate was then managed) for permission to relinquish their tenancies. The land, being in an extremely unsatisfactory condition and being a serious nuisance to the neighbouring Experimental Farm, the Committee who, had frequently written off large arrears of rent and had always experienced great difficulty in gathering in any rent, resolved, to take the land into their own management and, to write off all the arrears of rent.

200. The Committee, acting to some extent on my advice, determined to open a Commercial Farm on this abandoned land. At first, it was deemed necessary only, to crop the better soils (about 60 per cent. of the whole area) but, we soon found ourselves compelled to cultivate the whole area, from the rough untidy appearance the uncultivated land gave to the whole. And though, at starting we purposed doing no more in carrying out land improvements than, was absolutely necessary to admit of the soils being tilled, we had no alternative but, to undertake some very extensive and costly improvements.

201. During the first three years of the period over which the experiment extended, the low-lying land near the river, which is, naturally, the best in the whole area yielded satisfactorily; but, during the past two or three years several serious losses resulted from the cultivation of this land, caused by the destruction of several crops, by the River Adyar flooding the ground; while, from the deficiency of irrigation water late in the season, the re-sowings on this land seldom produced crops that reached maturity.

202. In the earlier stages of the experiment, the sandy soils appeared to be improving under cultivation, but, the extraordinary rainfall of 1872-73 showed that, but little permanent good could be effected towards the improvement of these soils until, they *were protected from the washing influences of flowing water* during heavy rain. At first, I was reluctant to incur the heavy expense that would result, from attempting to stop the wash, by levelling and terracing these sandy soils but, eventually I began the work seeing that, on these soils, all the benefits from good tillage and the application of manure were lost, whenever the rainfall was unusually heavy. Some of these soils, contained as much as 95 per cent. of

sand and, the land being undulating, it will readily be understood that, with a rainfall, sometimes, as much as 5 inches in a day, the loss, of soluble and portable manure, could not but be enormous. As, I have elsewhere mentioned, the land that has been levelled and terraced has improved very greatly.

203. There are many other reasons why this experiment was not attended with more satisfactory results; but, I have noticed these, so fully, in previous Annual Reports, it seems unnecessary again to detail them.

204. It will readily be understood, from what I have mentioned that, the site was altogether an unsuitable one for the purposes of a Commercial Farm; but the more serious objections did not disclose themselves until, the experiment had made some progress. Had it been possible, to have conducted the experiment, as was originally intended, without undertaking any costly land improvements, the expenditure would, of course, have been very much smaller. Though the money return was not so large as, could have been desired, the general result of the undertaking cannot be said to be unsatisfactory for, I believe, that *the land could now be sold for a price that, would represent its original cost with the whole of the net outlay added.*

205. The following statement, exhibits the income and expenditure of the farm during the past year :—

Expenditure.

	Rs.	A.	P.
Rent and interest (½ year)	512	12	9
Overseer's salary	730	0	0
Labor	1,305	4	1
Cattle	0	0	0
Pigs	83	9	0
Sheep	85	0	7
Poultry	119	11	6
Implements, machines, and tools	295	13	0
Seeds	181	15	11
Cattle food	604	10	9
Manure	259	1	6
Sundries	28	5	3
Total	4,206	4	4

Income.

	Rs.	A.	P.
Advance from General Funds	2,436	11	0
Cattle	10	12	0
Pigs	74	7	6
Sheep	273	15	2
Poultry, &c.	138	5	6
Fruits, plantain, and vegetables	448	14	1
Grains, fodder, &c.	527	6	9
Indigo, cotton and sundries	295	12	4
Total	4,206	4	4

206. The statements that follow show the expenditure on behalf of the experiment, and the income derived from it :—

Expenditure from the commencement of the Farm up to and including the 31st of March 1876.

Items.	1870-71.*			1871-72.			1872-73.			1873-74.			1874-75.			1875-76.			Total.					
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Cooly labor	1,105	4	2	1,375	9	11	1,369	14	0	1,317	1	11	1,589	12	4	1,475	8	11	8,233	3	3			
Manure	†3	0	0	†71	1	4	†185	2	7	†41	7	7	462	6	0	259	1	6	1,022	3	0			
Live-stock	1,641	15	0	731	6	8	636	3	0	252	10	3	333	13	4	288	5	1	3,884	5	4			
Food for live-stock	267	11	9	557	7	3	506	3	11	531	15	1	537	13	2	604	10	9	3,005	13	11			
Seeds, trees, &c.	194	1	7	91	6	7	153	9	2	122	13	5	182	10	1	181	15	11	926	8	9			
Implements, tools, &c.	461	9	0	18	13	0	277	8	6	67	5	0	334	1	4	295	13	0	1,455	1	10			
Contingencies	74	4	9	100	2	3	16	6	9	16	10	2	56	3	7	28	5	3	292	0	9			
																						18,819	4	10
Overseer's salary	113	12	0	370	0	0	600	0	0	610	0	0	647	8	0	730	0	0	3,071	4	0			
Rent	192	8	0	385	0	0	385	0	0	385	0	0	385	0	0	385	0	0	2,117	8	0			
Interest on capital employed in working the Farm	69	8	4	150	0	0	200	0	0	200	0	0	200	0	0	200	0	0	1,019	8	4			
Interest on capital expended on improvements of a permanent character	94	6	7	296	1	8	328	1	6	328	1	6	328	1	6	440	9	6	1,815	6	3			
																						8,023	10	7
																			Total ...			26,842	15	5

* Half year.

† In these years a number of cattle were fattened, and therefore more manure was made at the Farm.

Income from the commencement of the Farm up to and including the 31st of March 1876.

Items.	*1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			1875-76.			Total.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Cattle	403	1	9	560	14	9	371	15	0	419	7	5	85	0	0	10	12	0	1,851	2	11
Sheep	...	...	...	141	10	6	237	2	6	188	10	9	132	3	5	273	15	2	973	10	4
Pigs	...	...	...	263	14	0	664	5	9	390	11	6	344	0	11	74	7	6	1,737	7	8
Poultry, &c.	12	6	0	97	8	0	203	4	0	65	2	10	84	1	0	138	5	6	600	11	4
Fruits, vegetables, &c.	474	12	6	582	10	3	444	1	6	290	1	11	568	2	11	448	14	1	2,808	11	2
Hay, green fodder, &c.	42	8	0	256	6	0	484	13	6	238	11	3	150	1	10	196	5	5	1,368	14	0
Grains	407	0	10	705	9	3	178	11	2	411	5	7	258	1	9	331	1	4	2,291	13	11
Indigo and cotton	...	...	...	...	...	...	...	...	...	232	12	6	7	8	0	87	14	8	328	3	2
Sundries	101	10	3	228	4	0	301	9	10	113	3	6	345	7	10	207	13	8	1,298	1	1
Total ...	1,441	7	4	2,836	12	9	2,885	15	3	2,350	3	3	1,974	11	8	1,769	9	4	13,258	11	7
Add the valuation of the assets on the 31st of March 1876																			7,663	5	1
Total ...																			20,922	0	8

* Half year.

207. The next statement, exhibits the balance sheet of the year, excluding the additional value given to the property, by the improvements effected :—

Liabilities.

	Rs.	A.	P.
Loan from General Funds for 1870-71	2,776	9	10
Do. do. 1871-72	1,310	3	11
Do. do. 1872-73	1,772	2	2
Do. do. 1873-74	1,522	13	8
Do. do. 1874-75	3,082	9	8
Do. do. 1875-76	2,436	11	0
Laborers' pay due for March 1876	170	4	10
Half year's rent and interest not charged	512	12	9
Total ...	13,584	3	10

ASSETS.

Cattle.

	Rs.	A.	P.	Rs.	A.	P.
13 working cattle	800	0	0			

Sheep.

52 ewes 2 wethers 3 lambs	200	0	0		
Pigs	80	0	0		
Poultry	173	8	0		
				1,253	8	0

Implements.

Implements, tools, carts, &c., as catalogued	1,114	4	0

Manures.

Manure of sorts	25	0	0			
¼ cost of manure purchased in 1874-75	115	9	6			
¼ cost of cake purchased in 1874-75	134	7	3			
½ cost of manure purchased in 1875-76	129	8	9			
½ cost of cake purchased in 1875-76	302	5	5			
				706	14	11

Fruit and Fuel Trees, &c.

Cocoanut trees, mango trees, and casuarina trees. Guava trees and cashew-nut trees	3,000	0	0		
Young trees in Nursery	130	0	0		
Fruit crops	325	0	0		

Field Crops.

Grain and pulse crops ... ... Guinea-grass ... ... Fodder crops of sorts	350	0	0		
Dry fodder	40	0	0		
Cultivation done for next year	75	0	0		

Uncollected Bills.

Due by sundry persons	46	14	2		
Cattle labor performed in 1873-74, 1874-75, and 1875-76 in Estate improvements	621	12	0	668	10 2
Difference, being balance against the Farm				5,920	14 9
			Total ...	13,584	3 10

208. In the following statement, the final result of the experiment, is shown :—

Cost of the land ;—

	Rs.	A.	P.	Rs.	A.	P.
20 acres, at 53 Rupees	1,060	0	0			
91 acres, at 26 do.	2,366	0	0			
				3,426	0	0
Cost of buildings, roads, &c.				6,000	0	0
Balance to debit, shown in the Farm balance sheet				5,920	14	9
				15,346	14	9
Total cost, per acre				138	4	2
Probable selling price, per acre				140	0	0

209. Everywhere, the restoration of exhausted land is one of the most difficult of agricultural problems. A writer, in Fraser's Magazine of August last in referring to Irish Agricultural improvements says :—

" . . . . . My own case is an illustration. I borrowed £1,000 from Government during the famine. I have spent £25,000 on land improvements ; a steady outlay of 800 to 1,000 £ per annum for over 30 years on 4,000 acres. Yet I have not nearly done what is needed. It is only when any one comes practically to improve an estate in the backward condition so many Irish estates are in, that he knows what the work is. Everything has to be done. . . . . Land exhausted as much of the dry land is, needs years of outlay in manure to recover any moderate fertility as all practical farmers know."

210. If I had such an experiment again to direct, I would certainly insist upon fair agricultural land being selected and if, any land improvements were necessary would require that the whole of them likely to interfere with the cropping of the land should be finished before the regular agricultural work began. There is perhaps in cultivation, in this Presidency, no tract of land containing soils of such a low order as those that constitute so large an area of the land on which the experiment was conducted.

ESTABLISHMENT.

211. During the past year Mr. Benson had charge of the Sydapet Farms and Mr. Schiffmayer had charge of the works of permanent improvement carried out on the Sydapet Estate ; Mr. Schiffmayer was also engaged in conducting "laboratory experiments" until an unfortunate accident put a stop to his work in the laboratory. I have much pleasure in acknowledging the valuable aid afforded me by both gentlemen.

212. The Overseers and Clerks have given satisfaction in the performance of their respective duties. Clerk T. Vencatasawmy Naiker accompanied me during my tour in the Coimbatore District; and, by the tact and intelligence he displayed in performing the duty I entrusted to him, aided me, very materially

SYDAPET,
January 1877.

W. R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

APPENDICES.

EXPENDITURE ON ACCOUNT OF THE MADRAS AGRICULTURAL DEPARTMENT.

	RS.	A.	P.	RS.	A.	P.
I. *General Supervision.*						
Establishment*	17,929	14	5			
Travelling allowances	372	0	0			
Contingencies	370	9	3			
				18,672	7	8
II. *Madras Experimental Farm.*						
Establishment	1,054	0	0			
Cooly labor	2,908	6	5			
Implements and Machines	744	0	4			
Live stock	785	1	1			
Seeds	796	7	3			
Food for Live-stock	1,691	12	11			
Manure	477	9	3			
Despatching seeds	240	15	9			
Contingencies	220	15	4			
				8,919	4	4
III. *Madras Model Farm.*						
Establishment	730	0	0			
Cooly labor	1,305	4	1			
Manure	259	1	6			
Live stock	288	5	1			
Food for live stock	604	10	9			
Seeds	181	15	11			
Implements, carts, and water-lifts	295	13	0			
Rent and interest	512	12	9			
Contingencies	28	5	3			
				4,206	4	4
IV. *Implement Workshops.*						
Carpenters, smiths, and filer	955	5	9			
Cooly labor	233	4	10			
Machines, implements, and materials	1,170	12	1			
				2,359	6	8
V. *Educational.*						
District Farm Apprentices	525	12	11			
Sydapet do.	1,452	8	0			
Schoolmaster for laborers' children	34	12	0			
Books, &c., for library	201	15	9			
Contingencies	139	11	1			
				2,354	11	9
VI. *Estate Improvements of a Permanent Character.*						
Repairs to buildings, &c.	1,264	9	3			
Construction of field roads and repairs to similar roads ...	210	4	3			
Water channels	173	12	0			
Deepening wells	189	7	6			
Trees and planting	125	13	7			
Levelling and reclaiming land	75	0	0			
Carried forward ...	2,038	14	7	36,512	2	9

* Includes the salary of the Assistant to be placed in charge of the Coimbatore District Farm.

	Rs.	A.	P.	Rs.	A.	P.
Brought forward ...	2,038	14	7	36,512	2	9
Levelling land to be brought under wet cultivation	325	8	6			
Contingencies	92	11	7			
Building a sheep house	249	4	4			
Manufacture of drain pipes	731	8	1			
Extension of the Implement Workshops	222	9	3			
Brick and mortar bridges under main roads	179	10	1			
Removal and reconstruction of Engine Sheds	314	0	0			
Re-thatching Cattle-sheds at the Experimental Farm	204	1	8			
Building drying sheds for tile yards	238	7	4			
Assistant Superintendent's bungalow	4,431	10	7			
Compensation to Wudders	900	0	0			
				9,928	6	0
VII. *Other charges and transfers.*						
Inspector of Cattle-diseases	6,698	3	1			
Amount transferred to Local Funds under G.O., 16th October 1875, No. 2,049	50,000	0	0			
Paid Public Works Workshops by transfer	51	1	7			
Expenditure during 1874-75 brought to account in 1875-76 ...	3,532	15	4			
				60,282	4	0
Total ...				1,06,722	12	9

INCOME OF THE MADRAS AGRICULTURAL DEPARTMENT.

Adjusted balance at the beginning of the year	2,21,133	11	9			
Special Grant	20,000	0	0			
Receipts from the Surplus Pound Fund during 1875-76	66,945	0	5			
				3,08,078	12	2
Madras Experimental Farm	4,078	14	0			
Madras Model Farm	1,769	9	4			
Implement Workshops	2,140	1	9			
				7,988	9	1
Total ...				3,16,067	5	3
Balance in favor of the Madras Agricultural Department on the 1st of April 1876	2,09,344	8	6			

VALUATION of Live and Dead Stock belonging to the Sydapet Experimental Farm on the 31st of March 1876.

	Rs.	A.	P.	Rs.	A.	P.
Cattle—						
5 Bulls						
16 Bullocks	...	...	...	1,400	0	0
1 Cow						
3 Calves						
Sheep—						
44 Rams						
71 Ewes	...	...	...	900	0	0
4 Gimmers						
70 Lambs						
Carried forward ...				2,300	0	0

| | | |

	Rs.	A.	P.
Brought forward ...	7,709	2	4
Cattle Food.			
9,227 pounds of Ground-nut oil cake	126	13	11
Implements.			
Implements and tools as catalogued in Inventory	4,833	2	0
Total ...	12,669	2	3

Seeds supplied gratis during 1875-76.

Date.	To whom supplied.	Maize.	Cotton.	Carolina Paddy.	Sorghum Saccharatum.
		lbs.	lbs.	lbs.	lbs.
1st May 1875 ...	Chellappa Pillai	...	30	...	...
2nd June ...	The Secretary, Native Association, Mayaveram ...	3	55	100	10
17th July ...	Captain Nicholas	30	...	...	...
21st „ ...	A. Ruzsock Sahib, Veerapoor	...	15	10	...
27th „ ...	Shaik Abdool Rahiman Sahib	2	12½	15	...
1st Sept. ...	Nuzmodien Sahib, Sydapet	...	10	20	...
27th „ ...	Mr. Seshyengar, N. W. Provinces	...	15	20	...
13th Oct. ...	Collector of Kistna	...	10	...	...
„ ...	H. Nash, Esq., Salem	...	15	...	...
13th Nov. ...	Collector of Kistna	...	...	50	...
4th Feb. 1876.	Ramachendrarajoo, Vizianagram	10	10	...	10
11th „ ...	Monegar of Goodalore, Coimbatore	10	...	...	10
23rd „ ...	Collector of Coimbatore	50	...	...	25
28th „ ...	Colonel Ashburner	...	...	25	...
„ ...	Commissioner of Nilgiris	150	...	...	...
1st March ...	Ragoonada Row, Esq., Travancore	20	20	...	...
„ ...	Collector of Madras	150	...	...	...
8th „ ...	Deputy Collector of Madras	100	...	...	...
14th „ ...	Collector of Vizagapatam	110	...	...	...
21st „ ...	J. Fraser, Esq, N. W. Provinces	...	...	10	...
	Total ...	635	192½	250	55

Catalogue of Machines, Implements, Tools, &c., belonging to the Experimental Farm on the 1st of April 1876.

1 Chaff-cutter and universal mill, with bullock power, by Messrs. Ransomes and Sims.
1 Threshing machine, by Dray Taylor & Co.
1 Threshing machine with bullock gear and carriage, by Ransomes and Sims.
1 Winnowing machine, by Dray Taylor & Co.
1 Winnowing machine, by Ransomes and Sims.
1 Winnowing machine, by Hornsby and Sons.
3 Reaping machines, by Samuelson & Co.
1 Cylindrical corn screen, by Ransomes and Sims.
2 Drill sowing machines, 13 rows, by Garret & Co.
3 Bullock hoes.
2 Ploughs, by Ames & Co., Boston.
1 Turn-wrest plough and yoke, by Ransomes and Sims.
1 Bullock plough, by School of Arts.
1 Bullock plough, by Mint.
2 Bullock ploughs, by Ransomes and Sims.
1 Double mould board plough.
1 Large plough, with 2 wheels, by Ransomes and Sims.

1 Swing plough, by Roorkee Workshop.
2 Wet land ploughs, by Experimental Farm.
1 Two-wheel plough, with cultivator by Ransomes & Sims.
1 Sub-soil plough.
3 Country ploughs of different pattern.
1 Country plough from Napier Foundry.
1 Wooden roller.
1 Four-wheel waggon.
1 Stone trolley.
1 Root-pulper, by Ransomes and Sims.
1 Stone roller.
2 Sets of iron harrows with swingletree, by Ransomes and Sims.
1 Wood drag harrow, by Experimental Farm.
1 Iron chain harrow.
3 Country carts.
2 Water carts.
1 Sewage cart, by Gun Carriage Works.
2 Single bullock carts.
1 Overhead, bullock power, with shafts and gearing.
4 English carts.
1 Maize sheller, by Ransomes and Sims.
1 Barrow drill, by Experimental Farm.
1 Water elevator, by Burges and Keys.
1 Water elevator, by Mint.
2 Water elevators, by Experimental Farm.
3 English ladders.
1 Norton's tube well with a rotary motion.
1 English grindstone.
1 Farm bell.
2 Wheel hand-hoes.
2 Dutch hoes.
8 Hoes.
9 Cattle yokes.
1 Archmedian pump.
1 Cake-crusher.
1 Pump, by Roorkee Workshop.
1 Chain pump, by manual power.
1 Chain pump, by bullock power.
1 Combined mill and oil-cake breaker, by Ransomes & Sims.
1 Large platform weighing machine.
1 Large beam and scales.
1 Cotton gin, by Gordon & Co.
1 Cotton gin, by Donlop.
1 Cotton gin, by Platt Brothers.
2 Cotton gins, by Burges and Key.
1 Country cotton gin.
1 Malabar spoon bale.
2 Waterproof cart covers.
1 Sack-barrow.
6 Picottah buckets.
4 Leather buckets with ropes and gearing for double mhote.
1 Large wheel barrow.
11 Wheel barrows.
3 Hay frames for carts.
1 Hand cart.
2 Clocks.
9 Tables.
10 Chairs.
2 Writing desks.
1 Almirah.
3 Book cases.
1 Dynanometer.
1 Surveying level with stand staves, &c.
12 Feeding tubs.
4 Metal feeding troughs.
7 Wooden troughs.
1 Manure drag.
2 Bengal picks.
2 Hatchets.
2 Hand barrows.
5 Iron rakes.
30 Mamoties.
1 Large field rake.
9 Crowbars.
18 Picks.
2 Mattocks.
3 Forks of sorts.
1 Iron cash chest.
3 Shovels.
1 Bill hook.
1 Iron reel.
11 Grass knives.
4 Manure forks.
14 Digging forks.
4 Sets of bullock harness.
2 Surveying chains with pins.
2 Iron cisterns.
88 Specimen seed bottles.
2 Hedge knives.
3 Pairs of thorn pincers.
1 Ear punch for marking sheep.
1 Mercal, one half-mercal, and one measure.
2 Weeding spuds.
3 Pairs of sheep shears.
1 Dibble.
9 Spanners.
5 Mallets.
3 Rammers.
2 Hedge shears.
1 Poultry feeding cage.
2 Maize cob-stands.
8 Fork hoes.
2 Driving wheels.

1 Large rubbish screen.
1 Drain scoop.
1 Lactometer.
1 Single barrel fowling piece.
1 Pair of pan scales.
1 Branding iron for marking sheep.
2 Sickles.
1 Chester measure metallic tape, 66 feet.
9 Levelling boards.
2 Screw jacks.
1 Hoe fork.
1 Hand screen.
2 Cross staves.
3 Iron cots.
3 Benches.
4 Large hand hoes.
1 Small hand hoe.
1 Knife.
4 Reaping knives.
1 Country reaping knife.
1 Lantern.
1 Reading lamp.
1 Pruning knife.
1 Rabbit box.
5 Crates.
1 Sledge hammer.
1 Watering can.
1 Heavy stone cart.
2 Steel stone chisels.
1 Cast iron plough.
1 Steel plough.
1 Maize sheller.
1 Drain-pipe making machine.
2 Draining spades.
1 Set of bottle levels; chemical apparatus, mortars, pestles, glass beakers, &c.
1 Screening die, two pipe dies, 1 hollow brick die, 8 brick moulds, 1 rake for furnace, and 1 poker.
1 Plum level.
1 Table.
1 Set of toddy-drawing tools.
Funnel stands.
1 Almirah.
2 Ladders.

Implements, Machines, Tools, &c., belonging to the Model Farm on the 1st of April 1876.

3 Iron ploughs.
4 Combined ploughs.
1 Set of iron harrows with swingletree.
1 Set chain harrows.
1 Winnowing machine.
1 Drill sowing machine.
1 Grubber.
1 Drag harrow.
2 Country carts.
1 Box cart.
5 Reaping hooks.
8 Picottah buckets.
1 Chopper.
20 Feeding tubs.
1 Spade.
3 Small wheel-barrows.
6 Digging forks.
9 Yokes.
11 Planter's hoes.
1 Tub for well.
1 Scythe.
1 Measure.
1 Half-mercal.
1 Scale, triangle, weights, &c.
1 Large beam and cattle-weighing scale.
10 Fifty-six pound weights.
1 Table.
1 Hay fork.
6 Mamotties.
1 Pair pincers.
1 Turn screw.
1 Chisel.
1 Water cask.
1 Hand saw.
1 Hatchet.
1 Cold chisel.
1 Chaff cutter.
1 Lantern.
1 Steel.
1 Leyelling board.
1 Rake.
3 Picks.
1 Meat saw.
1 Hedge knife.
4 Spanners.
1 Crowbar.
1 Mallet.

List of Tools, &c., belonging to the Implement Workshops on the 1st of April 1876.

2 Large anvils.
1 Circular anvil.
1 Small anvil.
20 Tongs.
3 Bellows.
1 Screw plate.
4 Sledge hammers.
8 Small hammers.
6 Smith's chisels.
8 Punches.
1 Countersinking punch.
6 Dies or flat chisels.
2 Pairs of calipers.
1 Iron square.
1 Round file.
1 Half-round file.
1 Flat file.
29 Taps for screw plates.
1 Iron brace and 6 bits.
1 Filer's hammer.
1 Filer's cold chisel.
2 Hand vices.
7 Spanners.
2 Square files.
1 Bob drill.
2 Screw levers.
1 Bench with 2 vices.
3 Hand saws.
1 Cross-cut saw.
1 Pit saw.
1 Auger.
2 Jack planes.
1 Spoke shove.
1 Spirit level.
1 Shoeing rasp.
1 Pincer.
1 Compass.
5 Carpenter's chisels.
2 Set squares.
1 Angle square.
3 Gimlets.
1 Brace with 34 bits.
2 Adzes.
2 Turnscrews.
1 Plummet.
4 Saw files.
1 Rasp for wood.
2 Mallets.
1 Pair scales.
1 Cold chisel.
2 Chisels.

Furniture, &c., belonging to the Office of the Superintendent of Government Farms on the 1st April 1876.

4 Almirahs.
5 Tables.
7 Chairs.
1 Iron cash-chest.
1 Eight-day American time-piece.
1 Rain gauge.
1 Portable scale with weights.
1 Letter scale with tolah and ounce weights.
2 Ivory thermometers.
1 Aneroid barometer.
1 Do. compass.
1 Office folding-table.

List of Books added to the Government Farms' Library during 1875-76

Veterinary Medicines, their actions and uses, by Finlay Dun, 1874.
Flora Indica, or Descriptions of Indian Plants, by W. Roxburgh, M.D., 1874.
Chemistry, by H. E. Roscoe, 1874.
Physical Geography, by Archibald Geikie, L.L.D., &c., 1874.
Geology, by Archibald Geikie, L.L.D., &c., 1874.
Report on the Irrigation of Eastern Spain, by Clements R. Markham.
Text Book on Estimating, by James Schoury, 1872.
A Manual of Family Medicine for India, by W. J. Moore, 1874.
Suggestions in regard to Sanitary Works required for improving Indian Stations, 1869.
Rudimentary Treatise on Mineralogy, by D'Varley, 1859.
A Treatise on Mathematical Instruments, by J. F. Heather, M.A., 1849.
Rudimentary Treatise on the Drainage of Towns and Buildings, by G. D. Dempsey, C.E., 1854.
Rudiments of the Art of Building, by E. Dobson, C.E., 1854.
Rudimentary Treatise of the Principles of Design in Agriculture, by E. L. Garbett, 1840.
Rudimentary Architecture for the use of Beginners and Students, 1844.

Rudimentary Mechanics for the use of Beginners, by Charles Tomlinson, Vol. 6, 1859.
Pneumatics for the use of Beginners, by C. Tomlinson, Vol. 12, 1858-59.
Elements of Mechanics, by T. Baker, C.E., 1852.
Rudimentary Treatise on the Drainage of Districts and Lands, by G. D. Dempsey, C.E., 1859.
Rules and Formulæ for the computation and solution of the various Hydraulic Problems, &c., by Major J. F. Stoddard, 1866.
School Botany and Vegetable Physiology, by John Lindley, PH.D., 1858.
Medical and Æconomical Botany, by John Lindley, PH.D., 1859.
Rudiments of Hydraulic Engineering, by G. R. Burnell.
Rudimentary Treatise on the Drainage of Districts and Lands, by G. D. Dempsey, 1859.
A Treatise on Water Works, by Samuel Hughes, F.G.S., 1859.
Catechism of Agricultural Chemistry, by W. B. Tegetmeier.
The Works of Martin Doyle, 2 Vols., 1836.
The Daily Life of our Farm, by the Rev. W. Hott-Beever, M.A., 1871.
The Cattle, by W. C. L. Martin and W. H. Raynbird, 1862.
The Sheep, by W. C. L. Martin, 1862.
The Pig, by H. D. Richardson.
The Sketches of Rural Affairs, the Plough and Sickle, 2 Vols., 1845.
Manual of Gardening, by R. Riddell.
Rudiments of Geology, by David Page, 1854.
British Husbandry, by C. W. Johnson, F.R.S., 3 Vols., 1848.
Materia Medica of Hindoostan, by Anslie, 1813.
European Agriculture and Rural Economy, by Henry Coleman, Vol. I, 1846.
Popular Botany, by James Main, A.L.S., 1835.
Timber Trees.
Profitable Fowls and Eggs.
Journal of the Royal Agricultural Society of England, 2nd Series, Vol. XI, Part I, No. XXI, 1875.
Do. do. do. Part II, No. XXII, 1875.
Third Reader, describing the Products of Southern India, 1869.
First Mnemonical Lessons in Geometry, Algebra, and Trigonometry, by Rev. Thomas Penington Kirkman, M.A., 1852.
Rudimentary Treatise on Foundations and Concrete Works, by E. Dobson, C.E., 1850.
Rudimentary Treatise on the Power of Water, by Joseph Glynn, F.R.S., &c., 1853.
The Gardener, by Houlston and Wright.
The Shepherd, by Houlston and Wright.
How to make Money by Horses, by Harry Hieover, 1862.
Stockhardt's Agricultural Chemistry, by Arthur Henfrey, F.R.S., F.L.S., 1855.
Views of Nature or Contemplations on the Sublime Phenomena of Creation with Scientific Illustrations, by A. VonHumboldt, translated by the German by E. C. Otte and Henry G. Bohn, 1850.
Rudimentary Dictionary of Terms used in Agriculture, Civil, Architecture, Naval, Building, and Construction, Early and Ecclesiastical Art, Engineering, Civil Engineering, Mechanical, Fine Art, Mining, Surveying, &c., by John Weale, 1849-50.
Rudimentary Treatise on the Blasting and Quarrying of Stone for Building and other purposes, by Major-General Sir John Burgoyne, K.C.B., &c., 1849.
Introduction to the Study of Natural Philosophy, for the use of Beginners, by Charles Tomlinson, 1848.
Rudimentary Treatise on Limes, Cements, Mortars, Concretes, Mastics, Plastering, &c., by George R. Burnell, C.E., &c., 1856.
Rudimentary Treatise on Geology, for the use of Beginners, by Lieutenant-Colonel Portlock, R.E., F.R.S., F.G.S, &c., 1854.
Pneumatics, for the use of Beginners, by Charles Tomlinson, 1858-59.
Rudimentary Chemistry, for the use of Beginners, by Professor Fowns, F.R.S., 1854.
Rudimentary Art of Constructing and Repairing Roads, by Henry Law, C.E., 1855.
Rudimentary Treatise on Blasting and Quarrying of Stone, by Major-General Sir J. Burgoyne, K.C.B., &c., 1849.

Rudimentary and Practical Treatise on Perspective, &c., by George Pyne, 1852.

The Storage of Water, by J. Bailey Denton, M.INST.C.E., F.G.S., 1874.

A Gaeztteer of the Territories under the Government of East India Company and of the Native States on the Continent of India, by Edward Thornston, Esq., 1857.

Trigonometrical Survey of Mysore, Malabar, &c.

Animal Physiology, by William B. Carpenter M.D., F.R.S., F.G.S., 1851.

Cattle; their Breeds, Management, and Diseases, 1834.

Sheep; their Breeds, Management, and Diseases, 1841.

Treatise on Sheep, by Ambrose Blacklock, 1840.

The Pig, by William Youatt, V. S., enlarged and re-written by Samuel Sidney, 1860.

Fish Culture, by Francis, 1863.

Synopsis of the Species of the Class Mammalia, by Cuvier.

The search for Nitre and the true Nature of Guano, by T. E. Eden, 1846.

General Outline of the Organization of the Animal Kingdom and Manual of Comparative Anatomy, by Thomas Rymer Jones, F.R.S., 1855.

The Agricultural Instructor, by Edmund Murphy, A.B.

A Sketch of the Principal Families of Plants, by Arthur Henfrey, F.R.S., 1855.

Vegetable Physiology and Systematic Botany, by William B. Carpenter, M.D., F.R.S., F.G.S., 1850.

Italian Irrigation, by R. Baird Smith, F.G.S., 1852.

The useful Arts employed in the Production of Food, 1850.

The Nature and Properties of the Sugar-cane with Practical Directions for the Improvement of its Culture and the Manufacture of its Products, by George Richardson Porter, 1831.

The Culture and Commerce of Cotton in India, by Forbes Royle, M.D., F.R.S., 1851.

A short account of the Modes of Sewage Disposal in some of the chief towns of England, 1869.

Descriptive Botany, or the art of describing Plants correctly in scientific language, by Professor Lindley, F.R.S., 1874.

A Manual of the District of Cuddapah, by J. D. B. Gribble, M.C.S., 1875.

A Manual of Indian Cattle and Sheep, by Dr. John Shortt, 1876.

Bamboo considered as a Paper-making material, by Thomas Routledge, 1875.

Report on the preparation and use of Rhea Fibre, by J. Forbes Watson, M.A., &c., 1875.

Gums and Gum Resins, by Edwin T. Atkinson, B.A., Part I, 1876.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS

(MADRAS PRESIDENCY),

FOR THE YEAR ENDING 31ST MARCH 1877.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT PRESS, FORT ST. GEORGE.
1877.

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Read the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to H. E. STOKES, Esq., Secretary to the Board of Revenue, dated Sydapet, 22nd December 1877, No. 1,085 :—

I HAVE the honor to submit my annual report for the official year ending 31st of March 1877. A report on the results of the experimental culture of Carolina paddy in this Presidency forms a part of the annual report; this portion has however, in accordance with the directions of the Board, been already separately submitted.

2. As directed in the Proceedings of the Board, Miscellaneous No. 8,076, dated the 5th of June 1877, I forwarded to the Director of Public Instruction a copy of the portion of the report that refers to the Agricultural College.

THE

ANNUAL REPORT

OF THE

SUPERINTENDENT OF GOVERNMENT FARMS,

FOR THE

YEAR ENDING 31ST OF MARCH 1877.

INTRODUCTORY.

THE history of agriculture in this Presidency, during the past year is one continuous record of disaster, due chiefly to the unpropitious character of the weather. Hence, the operations of this Department were not so extensive as they would otherwise have been. Nevertheless, a good deal of useful work was done, and numerous facts gathered which cannot but prove useful in suggesting the direction, in which efforts should be made to avert from our agriculture, such calamitous results as those which were so severely experienced during the past year.

No District tours were undertaken by any of the Officers of the Department as, from the almost entire cessation of all agricultural work, it was thought that no good could result from such tours.

The Agricultural Exhibition, which was to have been held in February last, was again postponed.

The Agricultural College was opened in October last, and is now in full operation. It is gratifying to note that numerous applications for admission into it, were received from all parts of India and, in many instances from well-educated youths, likely to benefit from the instruction afforded in the institution, and, prove of use afterwards in the great work of agricultural improvement. The organization of the institution necessarily demanded much careful attention, and occupied a good deal of time. But, the results that have been secured and those that promise to follow, will fully compensate for the labor and time expended.

The drought, of course, proved very detrimental to the cultivation of the Sydapet Experimental Farm. The necessity of providing food for the large number of cattle and sheep on the Farm, prevented the carrying out of any extensive experiments on the land where irrigation water was available. However, the crops produced without irrigation water were, in several instances very satisfactory, especially those sown early; one crop of Sorghum Saccharatum, as will be noticed on perusing the Farm Report, yielded 5,000 lbs. of straw and 924 lbs. of grain, per acre; while, crops of Yellow Cholum and Planter's Friend yielded from 300 to 450 lbs. of grain and 2,500 to 4,000 lbs. of straw, per acre. The advantages that result from deep culture were very clearly shown in the past year. The most casual observer, in looking over the crops during the drought, could not have failed in noting the remarkable superiority of the plants growing on the deeply tilled soil, compared with those growing on the head-lands of the fields and other shallow cultivated land.

The appointment of Inspector of Cattle Diseases, was vacant during the year, Veterinary Surgeon Western who held it, having vacated the appointment for other duties. Veterinary Surgeon Adams was temporarily employed in connection with the outbreak of cattle disease in Wynaad and Coorg. Efforts are being made in Europe to procure a qualified Veterinarian for the vacant post. It is evident however from past experience that one Veterinary Inspector can effect but little good in dealing with a horned-stock amounting to about eight and a quarter million head, scattered over an area of about twenty-five million acres. It has been suggested that the Inspector should have stationed at the head-quarters of each District, an Assistant, of the grade of an Apothecary; such Assistants to be trained in the Agricultural College where, instruction is afforded in Veterinary Surgery.

It has been determined to make these annual reports something more than mere records of the condition and operations of the Department, in view to rendering them more generally useful. To this end, papers on agricultural subjects of interest, and, short reports on agricultural matters that have been submitted to the Board of Revenue, either by District Officers or, Officers of this Department, will be published with the annual reports. With the present report, there is not much of interest to be published regarding the agriculture of the Districts, due to the great difficulties that stood in the way of carrying out field experiments and, to the attention of those from whom otherwise reports might have been expected, having been absorbed in efforts for the preservation of the lives of those engaged in agriculture. A few papers are published which, it is believed, will prove useful to those engaged in agricultural pursuits.

The correspondence of the Department continues to increase and, as the increase is caused chiefly by more frequent communications with persons engaged in agriculture in various parts of the Presidency, this is very encouraging. Aid, in the shape of advice founded on experience, is willingly accepted from all who choose to afford it, and every effort is made to encourage inquiries, in this way valuable agricultural information is collected and diffused amongst those interested.

WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

SYDAPET EXPERIMENTAL FARM.

SECTION I.

GENERAL.

1. *Rainfall.*—It is of far more importance for an agriculturist to know how the rain of a district falls, as a guide to the climate of it, than the total fall. If rain is precipitated in heavy falls at intervals of considerable duration, the cultivation of unirrigated lands must be a matter of difficulty, whilst for irrigated lands heavy falls are advantageous by filling the tanks, &c.

Importance of knowing character of fall.

2. Judging from the statement given below, the rainfall register in this country is not of much use to the agriculturist, as the seasons are so uncertain and varying; it only tells, what general observation has already discovered, the distribution of rainfall during the year:—

Register poor guide.

	1870-71.			1871-72.			1872-73.			1873-74.			1874-75.			1875-76.			1876-77.			Sydapet Farm Average 7 Years.				Observatory Average 63 Years.	
		Falls.			Falls.			Falls.			Falls.			Falls.			Falls.			Falls.			Daily Falls.				
	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Ipch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Rainfall.	Under one Inch.	Over one Inch.	Total.	Rainfall.	Wet Days.
April	..	..	..	..	..	..	..	..	..	2·38	2	1	..	..	..	..	..	..	·81	1	..	·46	·43	·14	·57	0·71	1
May	..	..	..	·33	1	..	7·55	1	2	..	..	..	6·79	2	1	..	..	..	·55	3	..	2·17	1·00	·43	1·43	2·07	2
June	8·32	6	2	1·44	4	..	1·41	1	1	1·68	6	..	6·66	4	3	·32	4	..	2·82	3	1	3·22	4·00	1·00	5·00	1·99	7
July	8·48	8	3	6·44	4	2	2·95	5	1	1·50	9	..	5·46	7	1	·66	3	..	3·67	11	..	4·16	6·71	1·00	7·71	3·81	12
August	7·52	5	3	1·79	3	..	6·46	7	2	3·16	6	1	2·34	4	1	9·44	10	2	3·69	7	1	4·88	6·00	1·43	7·43	4·53	12
September	6·90	5	2	8·23	1	4	4·96	5	2	7·24	5	2	10·59	9	3	4·21	4	1	2·10	3	1	7·32	4·57	2·14	6·71	4·83	10
October	16·63	8	4	6·21	5	2	18·26	5	5	12·30	11	7	21·91	3	7	5·30	10	2	3·34	3	2	11·99	6·44	4·14	10·58	10·99	12
November	5·44	11	1	26·64	7	7	31·13	6	10	8·91	13	1	9·25	3	4	15·52	6	5	3·74	4	2	12·37	7·14	4·29	11·43	13·17	13
December	1·20	3	..	·19	1	..	7·22	2	3	10·90	2	3	5·11	3	2	2·99	6	1	·14	3	..	4·12	2·86	1·29	4·15	5·10	7
January	1·20	1	1	..	..	..	..	..	..	..	..	..	·10	1	..	..	..	..	·02	1	..	·73	·43	·14	·57	·99	2
February	·68	1	..	·75	1	..	6·23	2	2	..	..	..	..	..	..	..	..	..	..	..	..	1·11	·57	·29	·86	·30	1
March	·70	2	..	·06	1	..	..	..	..	..	..	..	·77	1	..	..	..	..	..	..	..	·19	·57	..	·57	·45	1
Total ..	57·07	50	16	52·08	28	15	86·17	34	28	48·07	54	15	68·98	37	22	38·44	43	11	20·88	39	7	52·72	40·72	16·29	57·01	48·94	80

From this statement it will be observed that, during the past seven years, the average rainfall of any one month has only in eight or nine cases approximated to the average registered during the past 60 years at the Madras Observatory, which is only 3 miles off. Comparing the average of the past 7 years here, with that of the past 60 years at the Observatory, the total for the year is 5 inches more; this excess occurring chiefly in September and June, whilst in December there is a deficiency.

Amount and season of fall irregular.

3. The usefulness of gentle showers at frequent intervals is acknowledged, and the statement endeavours in a measure to bring out the character of the rainfall by dividing the light and the heavy falls; it will be noticed that during the past 7 years 29 per cent. of the daily falls have been over 1 inch, varying from 45 per cent. in 1872-73 to 15 per cent. in 1876-77. In seven months only of the year is there usually a sufficient frequency of rain, that is from June to December inclusive; but, the monthly register is often delusive, as, owing to the high temperature that usually prevails, if a considerable lapse occurs between two falls of rain, all the bad effects of a prolonged drought will be seen, and although there may be an entry of a heavy rainfall and a large number of wet days in a month, that month may be most unpropitious for cultivation.

Proportion of heavy falls large.

4. *Season.*—The season has been a most unfortunate one for the agriculturist generally, more especially for the wet-land cultivator; for dry lands there was, as will be shown further on in this report, sufficient rain to mature fair crops of cereals, pulses, cotton, and indigo. The total deficiency of the rainfall from the average of the past 10 years was 29·38 inches, whilst the proportion of wet days to rainfall was higher, there being only 22 days fewer on which rain was registered, than the average.

Great deficiency.

5. Rain fell during April on only one day, which is about what is usually the case; in May 3 slight falls amounting in all to ·55 inches did not attain the average of 10 years by nearly an inch; during June, the same contrast with the average of previous years continued, the rainfall being only 2·82 inches on 5 days to an usual 3·14 inches in 6 days. July was marked by numerous small showers, falling chiefly during the latter part of the month according to the general custom, which, though more numerous than usual, the register shows to have been lighter. In August very light showers, instead of the usual falls of medium amount were, until the last week, registered, these were insufficient for cultivation, but tended to promote the growth of weeds; in the last week however a considerable fall occurred, which would, had September continued as it began, have enabled dry crops to have been grown with ease, and what were sown would not have been ruined by the drought, which set in after the 5th of that month, and to which must be attributed much of the loss of crop on dry lands during the past season; the deficiency of rainfall during these two months was 4·76 inches, whilst there were 7 fewer wet days. The failure of the north-east monsoon rains in October and November was the cause of the failure of the wet crop, because the tanks, which these rains usually replenish, were not filled; the deficiency of rain amounted to nearly 16 inches and there was a corresponding decrease in wet days. In December the same failure continued; and during the three concluding months of the year there was scarcely any rain, only a very slight shower in the middle of January, and a sprinkling in March too slight to register.

6. The following table gives the monthly falls of the present compared with that of the past 10 years:—

—	1876-77.		Average of 10 Years.		—	1876-77.		Average of 10 Years.	
	Inches.	Wet Days.	Inches.	Wet Days.		Inches.	Wet Days.	Inches.	Wet Days.
April	·81	1	·26	·6	November ..	3·74	6	13·00	12·3
May	·55	3	1·48	·9	December ..	·14	3	5·40	6·0
June	2·82	5	3·14	6·6	January ..	·02	1	1·08	1·4
July	3·67	11	4·15	8·8	February ..	..	..	·89	·8
August ..	3·69	8	5·02	9·8	March	..	..	·16	·5
September ..	2·10	4	5·53	9·0					
October ..	3·34	5	10·05	11·1	Total ..	20·88	47	50·16	67·8

7. In the next statement the rainfall of each week in the year is shown, this brings out more clearly the character of the season than the monthly statement does.

No. of the Week.	1876-77.		Average of the previous 10 Years.		No. of the Week.	1876-77.		Average of the previous 10 Years.	
	Inches.	Wet Days.	Inches.	Wet Days.		Inches.	Wet Days.	Inches.	Wet Days.
1st Week ..	..	..	·22	·2	27th Week ..	1·34	1	1·30	1·8
2nd do. ..	..	..	·03	·2	28th do. ..	1·01	1	1·22	1·4
3rd do. ..	..	..	..	..	29th do. ..	·54	1	3·52	3·6
4th do. ..	..	..	·01	·2	30th do. ..	..	..	3·45	3·6
5th do. ..	·81	1	1·34	·5	31st do. ..	·45	2	1·39	1·9
6th do. ..	·48	2	·07	·1	32nd do. ..	·12	1	2·14	2·1
7th do. ..	..	..	·04	·2	33rd do. ..	2·07	3	3·07	3·1
8th do. ..	..	..	·002	·1	34th do. ..	..	..	2·87	3·3
9th do. ..	·82	2	·001	·1	35th do. ..	1·55	2	4·25	3·2
10th do. ..	..	..	1·10	1·2	36th do. ..	..	..	3·58	2·2
11th do. ..	1·65	2	1·12	1·9	37th do. ..	..	..	1·18	1·9
12th do. ..	..	..	·40	1·7	38th do. ..	..	..	·51	1·0
13th do. ..	·42	2	·41	1·5	39th do. ..	·14	3	·09	·7
14th do. ..	..	..	·35	1·3	40th do. ..	..	..	·02	·4
15th do. ..	·72	4	1·21	1·7	41st do. ..	..	..	·003	·1
16th do. ..	1·22	3	1·05	2·9	42nd do. ..	·02	1	·47	·7
17th do. ..	·93	3	1·04	2·2	43rd do. ..	..	..	·59	·4
18th do. ..	·80	1	1·20	2·1	44th do. ..	..	..	..	..
19th do. ..	·22	1	1·48	2·6	45th do. ..	..	..	·70	·6
20th do. ..	·40	2	·75	2·0	46th do. ..	..	..	·002	·1
21st do. ..	·36	2	1·33	2·1	47th do. ..	..	..	·12	·1
22nd do. ..	2·71	3	·94	2·1	48th do. ..	..	..	·14	·2
23rd do. ..	1·81	2	1·20	1·9	49th do. ..	..	..	·08	·4
24th do. ..	·01	1	1·30	2·1	50th do. ..	..	..	..	..
25th do. ..	..	..	1·73	2·1	51st do. ..	..	..	..	..
26th do. ..	·28	1	·93	1·7	52nd do. ..	..	..	..	..

8. In the statement below the daily registrations of the year are given :—

April 1876.	May 1876.	June 1876.	July 1876.	August 1876.	September 1876.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	1	1 .. ·75	1	1	1 .. ..
2	2	2	2	2	2 .. ..
3	3	3	3	3	3 .. ..
4	4	4	4	4	4 .. ·57
5	5	5	5	5	5 .. 1·24
6	6 .. ·41	6	6	6	6 .. ..
7	7 .. ·07	7	7	7	7 .. ..
8	8	8	8 .. ·07	8 .. ·22	8 .. ..
9	9	9	9	9	9 .. ..
10	10	10	10	10	10 .. ..
11	11	11	11	11	11 .. ·01
12	12	12	12 .. ·25	12 .. ·32	12 .. ..
13	13	13	13 .. ·25	13	13 .. ..
14	14	14 .. ·40	14 .. ·15	14	14 .. ..
15	15	15	15 } .. ·95	15 .. ·08	15 .. ..
16	16	16 .. 1·25	16 }	16	16 .. ..
17	17	17	17	17	17 .. ..
18	18	18	18	18 .. ·28	18 .. ..
19	19	19	19	19	19 .. ..
20	20	20	20 .. ·27	20	20 .. ..
21	21	21	21	21 .. ·68	21 .. ..
22	22	22	22 .. ·65	22	22 .. ..
23	23	23	23 .. ·05	23	23 .. ..
24	24	24	24	24	24 .. ..
25	25	25 .. ·11	25 .. ·23	25 .. ·53	25 .. ..
26	26	26	26	26	26 .. ·28
27	27	27	27	27 .. 1·90	27 .. ..
28	28	28	28	28	28 .. ..
29	29	29 .. ·31	29	29	29 .. ..
30 .. ·81	30 .. ·07	30	30	30 .. ·28	30 .. ..
	31		31 .. ·80	31	
Total .. ·81	Total .. ·55	Total .. 2·82	Total .. 3·67	Total .. 3·69	Total .. 2·10

October 1876.		November 1876.		December 1876.		January 1877.		February 1877.		March 1877.	
	Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
1	1·34	1		1		1		1		1	
2		2		2		2		2		2	
3		3		3		3		3		3	
4		4		4		4		4		4	
5		5		5		5		5		5	
6		6		6		6		6		6	
7	1·01	7		7		7		7		7	
8		8		8		8		8		8	
9		9	·12	9		9		9		9	
10		10	1·04	10		10		10		10	
11		11	1·01	11		11		11		11	
12		12	·02	12		12	·02	12		12	
13		13		13		13		13		13	
14		14		14		14		14		14	
15		15		15		15		15		15	
16		16		16		16		16		16	
17	·54	17		17		17		17		17	
18		18		18		18		18		18	
19		19		19		19		19		19	
20		20		20		20		20		20	
21		21		21		21		21		21	
22		22		22		22		22		22	
23		23		23		23		23		23	
24		24		24	·10	24		24		24	
25		25		25	·03	25		25		25	
26		26		26	·01	26		26		26	
27	·30	27		27		27		27		27	
28	·15	28		28		28		28		28	
29		29	·85	29		29				29	
30		30	·70	30		30				30	
31				31		31				31	
Total	3·34	Total	3·74	Total	·14	Total	·02	Total	*Nil.*	Total	*Nil.*

9. *Establishment.*—At the end of October, on the opening of the Agricultural College, the class of Sydapet Farm Apprentices was abolished; other than this there were no changes in the establishment, and the conduct of all the members of it was generally satisfactory.

SECTION II-A.

CULTIVATION AND CROPS.

10. *Rotations and their value.*—Experience has shown that the continuous cropping of land with one crop, or with crops of close affinity, for a long series of years successively, renders the soil unproductive. To this exception may be made of lands so situated that they annually receive a deposit of silt from some river, or of lands to which, after each successive crop, manure containing the plant food removed by it is applied. The last-named system, although capable of maintaining the land in a permanent state of fertility, has been found not to be generally economical.

Continuous cropping exhausts the land unless certain conditions are fulfilled.

11. To overcome the difficulties mentioned, the alternation of the growth of different crops was adopted, and has been proved to be most effective.

12. The theory of rotations is explained by Boussingault as follows:—

"In reviewing the chief points examined, it will be seen that, as far as regards organic matter, the systems of culture which in borrowing most from the atmosphere, leave the most abundant residues on the land, are those which constitute the most productive rotations. In respect to inorganic matter, the rotation to be advantageous, to have an enduring success, ought

to be so managed that the crop exported should not leave the dunghill with less than that quantity of mineral substances which it ought to contain."

A leguminous good preparation for a cereal crop.

13. A leguminous plant if grown before a cereal has been found to have marked effect on the succeeding crop, even if the leaves, stems and grain be removed. This is explicable from the great richness in nitrogenous matters, which are so much needed for the growth of cereals, that the roots of leguminous plants possess. A knowledge of the effect of leguminous crop, as a manure for cereals, is shown when the ryot grows a crop of black or green gram (*Phaseolus*) on wet lands for the benefit of the succeeding crop of paddy; although, in this case it may be said, that the leaves and stems are returned, and so cause the increase of production, yet, if the experiment of grazing the gram crop with sheep were tried, the result would, there is no doubt be more profitable.

A grain more exhaustive than a fodder-crop.

14. It has been proved that, when a crop is grown for seed, the soil has much more phosphorus, potassium, &c. removed from it than if the crop be grown for its leaves and stems only. Thus it is that a crop cut green for fodder does not exhaust the land so much as a crop that is allowed to mature its seed.

Variable amount of ash constituents in different plants.

15. The analyses of the ashes of different plants show that their composition is very similar in the same family, but that those of different families vary greatly. Thus the ash of leguminous crops is usually rich in lime, and that of cereals in silica. From this habit the advantages of alternating crops may be in a measure explained, as it is known that, although an analysis may show a soil to contain all the elements required for the growth of a particular crop, a further examination into the state in which these constituents exist may show that some element, especially required by the crop it is intended to grow, is only present in a condition in which it is practically unavailable in sufficient amount to produce a good crop.

Cultivation and nature change constituents of soil.

16. It is known that by the operations of cultivation, and by the forces of nature, the constituent parts of a soil become gradually changed in their composition, so that, although in one year, a piece of land may be unable to grow a *profitable* cereal crop, it may in a second be able to do so, even if, during the first year, a crop of another family be grown on it.

Root growth of plants varies.

17. Research has also shown, that the roots of different plants seek for and absorb their food in different parts of the soil, some going into the subsoil, some only subsisting on the surface. By alternating crops which seek their food in different parts of the soil, it is possible to allow some portion of it to lie fallow. And here it may be remarked that the roots of plants open up and aërate the soil; if a plant be deep-rooted, by penetrating downwards it places a greater depth of soil at the service of the cultivator; if its roots be wide-spreading, they increase the organic matter in the surface, and aërate it also when they decay, thus improving the physical condition wherever they go.

Encouragement and obstacles to weeds.

18. Some crops encourage the growth of weeds, owing to the difficulties their habit of growth presents to thorough interculture; other crops, by the dense covering they afford, kill out many weeds which would otherwise become overwhelming; again there are other crops which it is possible to cultivate, hoe, and weed, thoroughly during their growth. Thus by adopting rotations the land may be kept clean and be benefited by the continual culture it experiences under some crops.

Destruction of insects.

19. Some crops are attacked by particular insects, which deposit their larvæ in the ground wherever the crop on which they are feeding is growing. If the same crop be taken on this land successively it will suffer more and more from insect attacks, whilst if different descriptions of crop be grown, the insect, being deprived of its food, would probably die.

Economy of labor.

20. It is the object of every agriculturist to economise labor, and to do this efficiently, the seed-time must be extended over as long a period as possible. In temperate climates, the seed-time extends

throughout nearly the whole year. Here owing to the character of the season, it is not possible to extend the seed-time very much; but to a certain extent it is, and, in constructing a rotation for any locality, the climate, having a most important part to play as regards the Labor Bill, must be carefully considered.

An applicable rotation.

21. As a rotation for dry lands applicable to many soils; including amongst the crops suggested two of the most valuable products commonly grown in Southern India; providing an adequate supply of food for man and beast; not presenting a system of exhaustive culture, in too repeatedly growing the same crop or description of crop; and enabling the land to be kept free from weeds, the following may be suggested:—

1st year—Corn crop and cotton.
2nd year—Indigo.
3rd year—Corn crop followed by a catch crop of gram.
4th year—Guinea grass.
5th year—Guinea grass.

22. This would give annually on a 20-acre holding—

8 acres of corn.
4 acres of indigo.
4 acres of cotton.
8 acres of grass.

Crops chiefly consumed on the land.

23. The only crops in such a rotation, which would actually be sold off the land, would be the cotton and indigo; the corn crop being used for the support of the cultivator, his family, and of such laborers as he employed, would not be lost, as the ordure and rubbish from their houses might be collected and returned to the land.

Cotton provides cattle-food and fuel.

24. The cotton seed would provide food for the cattle, and if there were a surplus of corn grown, a portion might be sold and an equivalent amount of cattle food or manure purchased. The cotton stalks would provide some fuel for household use, and the ashes left from them would form a valuable addition to the compost heap.

Indigo not an exhaustive crop but manural.

25. Indigo should not be an exhausting crop under skilful management. The dye is the only product that must be removed; the refuse from the vats, consisting of nearly the whole plant, being brought back, would when rotted form a valuable manure. Indigo, the roots of which penetrate deeply, thus tending to open up and aërate the soil and so improve it, would leave the land in a condition fit to carry the second corn crop of the rotation, which however should receive a top-dressing of some manure, such as saltpetre, the value of it being recouped by a sale of a portion of the grain grown.

26. If a gram crop were grown it should be used as a manure, either by being fed off with sheep, or by being ploughed into the land green; the latter mode of manuring is most efficacious in many instances, especially when the soil is retentive or apt to set, and also when it is deficient in organic matter.

Guinea grass good fodder—under it land fallowed.

27. The two years under guinea grass might be reduced to one on many lands, and would take the place of the system now practised of leaving land "waste"; under this grass, the land would produce a good crop of fodder; be kept in continual cultivation; cleaned of weeds, and the insects and parasites which might have attacked the previous crops would die out, so that, at the end of the rotation, the land would be left in good heart to grow the first crop of the next series.

Rotation for stronger soils.

28. On stiff strong rich soils, instead of planting guinea grass in the fourth year, an early sown cholum crop, cut green for fodder, followed by a leguminous crop, such as black or green gram, which, being harvested in the early part of the year, could be succeeded by a summer crop of gingelly; in the fifth year indigo might again be taken, followed

in the sixth year by a corn crop, in the seventh and eighth years by guinea grass. The rotation would then run as follows:—

1st year—Corn and cotton.
2nd year—Indigo.
3rd year—Corn and gram as summer crop.
4th year—Cholum cut green, followed by a leguminous crop and by gingelly as a summer crop.
5th year—Indigo.
6th year—Cholum and gram as catch crop.
7th and 8th years—Guinea grass.

29. Another variation might be made, instead of indigo in the fifth year corn and cotton might be introduced, and another year added to the rotation, which would then become a nine-course one.

30. *Deep Cultivation.*—Year by year experience of the results seen on this farm confirms the opinion, "that the *value* of deep culture can, for usefulness in India, be scarcely overrated." The past year has been more fruitful than ever in facts demonstrating this point. Those fields, which were more deeply cultivated, gave better returns than others in which so deep a tilth was not obtained; and in all, the head-lands, which, owing to the constant treading of the cattle in turning, were not so deeply cultivated as the rest of the field, presented a most marked difference in the crop they produced.

Value incalculable.

31. The table given below is a statement of the results of the deep cultivation of the body of a field, contrasted with those produced by the shallow cultivation of the head lands:—

No. of Field.	During Growth.		Duration of Growth.	Nature of Cultivation.	Area of Plot.	Yield of Straw.	Yield of Straw per Acre.	Yield of Grain.	Yield of Grain per Acre.
	Rainfall.	Wet Days.							
					SQUARE YDS.	LBS.	LBS.	LBS.	LBS.
16	·16	3	87 days.	Deep..	16,027	11,456	3,459·6	221	66·7
				Shallow.	2,180	216	479·5	4·5	9·99

32. It will be seen, that from the more deeply cultivated part of the field the yield of straw was at the rate of 3,459 lbs. per acre, whilst, from the head-lands it was only about 480 lbs., or less than one-seventh; the outturn of grain was in both cases very small, but, as the head-lands only yielded at ⅐ the rate the rest of the field did, the effects of deep culture are equally obvious.

Deep cultivation gave seven times more produce.

33. The whole field had been heavily manured throughout, and if anything the head-lands received more than their share of the manure.

34. Seeing that the head-lands were cultivated fully as deeply and as well as is the ordinary practice of the country, this case shows what may be done, towards lessening the effects of the droughts we suffer from, by adopting a deeper tillage of the soil; for during the growth of this crop only ·16 inches of rain fell. The seed was sown after a week's dry weather, which followed a fall of 1·55 inches, before which there had been no rain at all for more than a fortnight. The point here brought out is of vital importance, for, if fodder could be produced in such quantities as were in the case referred to, there would never be such terrible losses of cattle, as there have been during this year. Although in this case the yield of grain was very low, during the same season with other crops planted at an earlier date, and thus receiving more rain, 300 to 500 lbs. of grain per acre were produced under similar management.

Effects of droughts intensified by shallow culture practised generally.

Fodder at least provided in case of droughts.

35. *Small and large Fields.*—A further consideration of the table given in paragraph 31 shows the advantage of having large fields instead of small; in that the proportionate area of head-lands is much less.

36. In this case, in a field of $3\frac{3}{4}$ acres, 12 per cent. of the area was taken up with head-lands, this caused a loss, from the stunted crop which grew on the head-lands, of 1,307 lbs. straw and $25\frac{1}{2}$ lbs. of grain, worth about Rupees 7-8-0, or about Rupees 2 per acre. If the field had been smaller, the loss per acre would have been heavier, as the width of the head-land must in all cases be nearly the same.

Great loss of crop from small.

37. For economy of working, long and broad fields, provided they are not too long for the cattle to plough from end to end without a pause or check, are far superior to short and narrow ones, as the time consumed in turning is less proportionately to that whilst at work than in short fields.

Costly to work small.

38. In small fields the boundaries between each field occupy a considerable percentage of the area of cultivated land, whilst, if the fields are large, this area forms only an insignificant portion of the total. Every boundary, whatever it consists of, forms a nursery for weeds from which their seeds can be distributed to the land around, so that the fewer and smaller these nurseries are the better.

All boundaries need nurseries.

39. *Crops grown.*—The following table gives the outturn of several crops grown during the past season, and is worthy of notice :—

1	2	3	4	5	6	7	8
Description of Crop ..	Sorghum.	Planter's Friend.	Yellow Cholum.	Yellow Cholum.	Yellow Cholum.	Yellow Cholum.	White Cholum.
Number of Field ..	4	34	33	32	14	18	16
	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.	SQ. YDS.
Area of Plot	8,470	6,930	17,632	22,990	4,985.	19,602	18,207
Date of sowing ..	17th October 1876.	18th October 1876.	10th October 1876.	5th October 1876.	9th October 1876.	15th Nov. 1876.	8th Dec. 1876.
Amount of seed sown..	14 lbs.	40 lbs.	75 lbs.	120 lbs.	50 lbs.	76 lbs.	73 lbs.
Seed sown per Acre ..	8·00 lbs.	27·93 lbs.	20·58 lbs.	25·26 lbs.	48·54 lbs.	18·76 lbs.	19·40 lbs.
Date of reaping ..	24th Jan. 1877.	31st Jan. 1877.	15th Jan. 1877.	5th Jan. 1877.	22nd Jan. 1877.	13th Feb. 1877.	3rd March 1877.
Duration of growth ..	100 days.	106 days.	98 days.	93 days.	106 days.	91 days.	87 days.
During growth—							
Rainfall	4·75 in.	4·35 in.	4·75 in.	5·74 in.	4·75 in.	1·71 in.	·16 in.
Wet days	13	12	13	14	14	6	3
Yield of—							
Straw	8,948 lbs.	5,600 lbs.	10,096 lbs.	11,928 lbs.	4,085 lbs.	10,328 lbs.	11,672 lbs.
Grain	1,615 lbs.	650 lbs.	1,640 lbs.	1,525½ lbs.	* 164 lbs.	480 lbs.	225½ lbs.
Yield per Acre of—							
Straw	5,103 lbs.	3,911 lbs.	2,771 lbs.	2,511 lbs.	3,964 lbs.	2,540 lbs.	3,103 lbs.
Grain	924 lbs.	454 lbs.	450 lbs.	321 lbs.	*159 lbs.	118 lbs.	560 lbs.

* A large amount of the produce of this field was stolen which causes the low outturn.

40. From this statement it will be seen that crops sown early in October produced from 2,500 to 5,000 lbs. of straw, and from 320 to 920 lbs. of grain; whilst others sown later, although the outturn of straw was nearly as great, show a great falling off in that of grain; this must be attributed to the smaller amount of rain that fell during their growth.

Fair crops produced without irrigation.

41. These results show in a great measure what may be done, even on light soils like that of this farm, to produce crops with even as light a rainfall as there was during the past year. The results may be attributed to the depth of cultivation, the value of which in a droughty season has already been dwelt upon, and to the manuring which all the fields received. In order to understand and appreciate the results shown in the statement, some remarks regarding each crop are given here.

Result attributable to good system of culture.

42. The Sorghum crop was grown on a piece of light sandy loam, which had lain fallow during the previous year and was heavily manured with box manure; the crop was also top-dressed with saltpetre, and, to the thoroughly cultivated and high manural state of the land, the result obtained may be attributed. It will be seen that the seed sown was as little as could possibly be used with any good results, but it is probable

that, had the crop been slightly thicker on the ground, the results would have been better.

43. The crop of Planter's Friend was grown on a light soil of average quality, which had been extremely well cultivated: it only received as manure a top-dressing of saltpetre.

44. The two Yellow Cholum crops first on the table were grown in adjacent fields of similar quality; the difference in outturn may be attributed to the first field having been more thoroughly cultivated, and to the fact that the crop in it succeeded one of indigo; whereas in the second field the cholum followed a crop of maize and cotton, and further that in this field there were several more trees, which always cause a considerable diminution of crop on the land immediately surrounding them.

45. The third crop of Yellow Cholum was grown in a field, of very similar quality to the last, which had been most thoroughly cultivated, and had received a good dressing of manure.

46. The last crop of Cholum on the table was grown on a light sandy field, which had been heavily manured with horse manure, and was top-dressed with a dressing of salt and dissolved Peruvian Guano. It should be observed how little rain this received during its growth, but in connection with this it must also be noted that, five days before the crop was sown, there was a fall of over 2 inches, which saturated the seed-bed, and thus enabled the seed to germinate.

47. The crop of White Cholum sown on December 8th is really a most wonderful crop, considering that during its growth all the rain it received was ·16 inches. The land was in good condition from deep cultivation and a heavy manuring of horse manure.

48. The following is a statement of the actual cost of production, and a valuation of the outturn, of the crops referred to in the table given in paragraph 39, excepting that grown in No. 14 field, which it is useless to include owing to the pilfering of the produce which took place:—

Crop.	Sorghum Saccharatum.	Planter's Friend.	Yellow Cholum.	Yellow Cholum.	Yellow Cholum.	White Cholum.
Field grown in	No. 4.	No. 34.	No. 33.	No. 32.	No. 18.	No. 16.
Area	SQ. YDS. 8,470	SQ. YDS. 6,930	SQ. YDS. 17,632	SQ. YDS. 22,990	SQ. YDS. 19,602	SQ. YDS. 18,207
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Cost of seed	1 12 0	1 10 0	2 8 0	4 0 0	2 8 0	5 0 0
Labor in cultivation, &c.	24 6 0	18 15 0	41 12 6	43 12 6	25 0 0	41 15 0
Do. in harvesting, &c.	5 13 6	2 11 0	16 3 0	17 13 0	12 5 0	9 11 0
Labor and seed	31 15 6	23 4 0	60 7 6	65 9 6	39 13 0	56 10 0
Do do. per Acre	18 4 3	16 3 9	16 9 7	13 12 11	9 13 3	8 14 6
Cost of Manure	52 8 0	23 8 0	19 2 8	19 13 0	28 12 0	33 8 0
Do. do. per Acre	30 0 0	16 6 7	5 4 3	4 2 2	7 1 5	8 14 6
Value of Straw	30 3 6	22 6 5	40 6 2	47 11 4	41 4 11	46 10 0
Do. do. per Acre	17 6 2	15 10 4	11 1 4	10 7 8	10 3 2	12 5 5
Value of Grain	80 12 0	26 0 0	54 10 8	50 10 5	16 0 0	9 0 0
Do. do. per Acre	46 2 3	18 2 6	15 0 1	10 10 7	3 15 2	2 6 3
Gross Outturn	110 15 6	48 6 5	95 0 10	98 5 9	57 4 11	55 10 0
Do. do. per Acre	63 8 5	33 12 10	26 1 5	21 2 3	14 2 4	14 11 8
Gross Cost	84 7 6	46 12 0	79 10 2	85 6 6	68 9 0	90 2 0
Do. do. per Acre	48 4 3	32 10 4	21 13 10	17 15 1	16 14 8	17 13 0
Value of Manure carried to next crop.	26 4 0	12 12 0	9 9 0	9 14 0	14 6 0	16 12 0
Do. do. per Acre.	15 0 0	8 3 0	2 10 0	2 1 0	3 8 0	4 7 0

Cost of labor and manure.

49. The total area of the crops referred to is 19·39 acres. The gross cost was Rupees 454-15-2, or about Rupees 23-8-0 per acre, of which Rupees 9-3-0 was for the manure applied, and Rupees 14-5-0 for labor and seed; the cost of manure, it will be seen, varies in different cases from Rupees 4-2-2 up to Rupees 30-3-6 per acre, and the cost of labor and seed from Rupees 8-14-6 to Rupees 18-4-3.

Gross return.

50. The gross return per acre varies even more than the cost of production, for, though the average is Rupees 18-13-5, the crop of sorghum returned Rupees 63-8-5 and that of yellow cholum in No. 18 only Rupees 14-2-4 per acre.

51. The average gross return is less than the gross cost of production, but, if a valuation of the manural matters left in the soil after the first crop be deducted from the cost of production, it will be seen that a small balance per acre is netted; this, it must be remembered, is after paying a high price for hire of cattle and for cooly labor. Of the sum expended on labor, at least 50 per cent. would under ordinary circumstances represent the value of the labor of the ryot and of his family; this amount being the remuneration he would receive in growing such crops. It is further questionable whether the full cost of the labor expended on the crops referred to can be fairly charged to them, for a great deal of cleaning the land was done, the effects of which will not be lost for some time. The rates at which the produce was valued were, yellow cholum 30 lbs. per Rupee, straw 250 lbs. per Rupee, excepting in the case of sorghum a portion of which weighed green was only valued at 300 lbs. per Rupee, sorghum seed 20 lbs. per Rupee, and the planter's friend and white cholum seed 25 lbs. per Rupee; these prices are all exceedingly moderate for the season. And in reality, straw was at the time unobtainable for double the price named, and grain has since attained a much higher figure, and which could have been obtained if a market had been waited for.

Terms of valuation which are very low.

52. Maize (*Zea Mays*).—A plot measuring 2,418 square yards, was sown with this crop; and, under occasional irrigation, it produced, between November 8th and February 6th, 6,108 lbs. of fodder, which is at the rate of 12,226 lbs. per acre. The rainfall during the period of the growth of this crop was 3·90 inches, and it received 8 waterings; it was manured with about 12 loads of stable manure, and received a top-dressing of 50 lbs. of saltpetre.

Heavy crop of fodder.

53. Cotton (*Gossypium Indicum*).—The season prevented the usual sowings in September from succeeding, and it was not until nearly the end of November that any crop that was sown grew well; a plot sown then has thriven wonderfully, and, aided by the deep tillage of the land on which it is growing, been able to withstand the drought, yielding fairly—though of course not so heavily as it would in a good season; as the season is not completed the full details of the crop will be given in the next report.

Season unfavorable for, but fair crop obtained.

54. A point, which should have a most material influence on the selection of the seed-time for cotton, has until now received no attention; it is the period of the year during which the yield of lint from the cotton plant is greatest. As bearing on this point, in the statement given below, the results of the different ginnings of the cotton gathered during the season of 1876 are recorded:—

Period of greatest yield of lint not inquired into most important.

Date of Ginning.	Amount Ginned.	Amount of Lint.	Percentage of Lint.	Details of Gatherings.
	LBS.	LBS.		
28th February 1876 ..	445·5	154	34·57	128 lbs. gathered before 1st January. 102·5 lbs. do. do. in January. 115 lbs. do. do. in February.
12th May ,, ..	602	220	36·55	53 lbs. do. do. in do. 251 lbs. do. do. in March. 298 lbs. do. do. in April.
17th do. ,, ..	181	58	32·04	32 lbs. do. do. in do. 169 lbs. do. do. in May.
16th June ,, ..	146	48	32·88	Gathered between May 16th and June 10th.
18th July ,, ..	372	98	26·34	Gathered after June 10th.
4th August ,, ..	246	42	17·07	
16th do. ,, ..	212	59·5	28·07	Gathered after July 18th.
24th do. ,, ..	197·5	52	26·33	
1st September ,, ..	187	58	31·02	
25th do. ,, ..	72	21·5	29·86	Gathered after August 24th.
Total ..	2,661·0	809·0	30·40	

55. It will be noticed that there is a great variation in the yield of lint at different times of the year, the cotton gathered during the earlier months yielding a much higher percentage than that picked later on. Thus the percentage of lint in

the cotton gathered before June 10th was 34·92, and, in that which was gathered between June 10th and the end of August, it was only 24·28, or about 10½ per cent. less. The yield of cotton in seed, during the first of the above-named periods, was 74·75 per cent. of the total gathering. The gatherings in September show a very high percentage yield of lint, but, as it was an unseasonably dry month, especially after the first week, the outturn in it must be taken as exceptional.

Percentage highest in early months as well as greatest yield.

56. Looking at the rainfall of the four months—May, June, July, and August—it will be noticed that one inch less than the average of the past sixty years, or more than 3 inches less than that of the past ten years, was registered; the chief difference being in the fall during the month of May, so that the long dry season was rather more protracted than usual; no rain fell from December 17th of 1875 until April 30th, 1876, when, after a drought of about eighteen weeks, ·81 inch fell, followed by four slight falls before June 10th amounting in all to 1·30 inches, which falls, considering the temperature of the air, and the dryness of the soil at the time when they fell, could have little permanent effect.

57. From the results of the ginnings recorded, it appears that after July it would generally be undesirable to keep cotton on the land; for, not only is the outturn shown to be chiefly given in the early months of the year, and that the percentage of lint produced after June is low, but also, during the showery weather of July and August, it is most difficult to keep down the weeds, and in all probability, if the crop is kept on the land for a longer period in the hope of obtaining rather more yield, the succeeding crop will be endangered, and great expense will be necessitated to clean the land again.

Advisable to remove cotton after July.

58. It would be better to sow the cotton crop at an earlier date than has been customary; instead of September, August should be the month chosen; by this means, cotton-picking might begin at the end of December, instead of the end of January or the beginning of February which has been until now the usual season. By this means a longer gathering season during the early months of the year, when the percentage of lint is greater, the staple longer, the sample usually much cleaner and not stained with oil, would be obtained, and the temptation to keep the crop on the ground late in hopes of obtaining a further gathering would be lessened.

August sowing will give a longer gathering season.

59. Indigo (*Indigofera tinctoria*).—The growth of this valuable crop is attended with considerable difficulties. The seed-time, adopted on this farm, is usually characterised by very uncertain weather, and the difficulty, in obtaining as good a seed-bed for the seed as is requisite, is great, as well as the chance of a heavy fall of rain caking the surface of the ground, and thus preventing the young germs from coming through. When a fair plant has been secured, there is no crop that we possess more hardy and less subject to the influence of dry weather than indigo. Three cuttings can be easily taken from it during the season, and it can be removed in August or September in time to allow the land to be prepared for another crop.

In first stage growth difficult plant hardy.

60. On the 11th of December, a field of about 4 acres was sown with this crop, and, although the drought prevented a good even plant being secured over the whole field, the outturn has been most satisfactory, and points clearly to the good effects of deep cultivation. The crop was not watered, and received during the first five months it was on the ground ·16 inch of rain only. Full details of the crop will be given in the next report, for as yet the returns have not been all realized, but it may be remarked that the first cutting, which was reserved for that purpose, yielded 913* lbs. of seed, and the second 13,475 lbs. of green indigo which was sold for Rupees 34.

SPECIAL CROPS.

61. Locust or Carob Bean (*Ceratonia Siliqua*).—In 1866 some seedlings of this tree were obtained and planted on a piece of land in a good situation on this farm; but until this year they never produced any fruit. There are now 5 trees, only one of which, however is a female one.

Trees eleven years old.

* Valued at Rupees 61.

62. The trees were planted in a line, which arrangement, owing to the habit of the tree, is unadvisable, and might have explained the reason why no fruit had been produced before, were it not that the solitary female one has at last done so.

Tree dioecious—planting risky unless seedlings are grafted.

63. The risk which must always attend planting the tree, owing to its being dioecious (the male and female flowers being borne on separate trees), and there being no method of ascertaining the sex of the plant until it flowers, is forcibly illustrated in this case, as of five trees planted only one of them has turned out to be a female one. To overcome this, grafting the seedling should be adopted, as by grafting from known female and male trees, a certainty as regards the sex of the trees can be depended on; the grafts thus raised can afterwards be planted out at convenient distances, allowing a large number of female plants to each male one.

Trees small and make no progress.

64. The trees growing here are about 17 feet high, and the stems, at 1 foot above the ground, measure about 20 inches in circumference, but for the last few years they have made no apparent increase in size; this can scarcely be attributed to the climate, for the trees do not seem to suffer even in the hottest weather, but is probably due to the fact that the soil on which they are growing is deficient in lime.

65. The following extract from a paper by Dr. A. Voelcker, F.R.S., shows the nutritive and fattening qualities of the pod as a food:—

"Locust-meal, as will be seen by the following analyses of three samples analysed in my laboratory, contains in round numbers fully half its weight of sugar, and in consequence is very palatable and much liked by horses, sheep, and cattle.

"Composition of Locust, Carob-Bean, Meal.

—	No. I.	No. II.	No. III.
Moisture	17·11	12·61	14·22
Oil	1·19	1·08	·96
Sugar	51·42	50·30	54·07
Mucilage and digestible fibre	13·75	20·13	14·41
* Albuminous compounds	7·50	5·87	7·72
Woody fibre	6·01	7·14	5·88
Mineral matter (ash)	3·02	2·87	2·74
Total	100·00	100·00	100·00
* Containing nitrogen	1·20	·94	1·25

"In addition to the constituents mentioned in the preceding analyses, carob-beans contain variable quantities of butyric acid, which impart to the crushed beans or meal a peculiar flavor. The meal is deficient in albuminous compounds, and for this reason it is desirable not to feed cattle too freely upon it, but to mix it with peas or bean-meal, or decorticated cotton-cake, or similar feeding materials rich in nitrogenous compounds."

Useful as a condiment.

From the qualities that this extract shows it to possess, it is more suitable for use as a condiment than as a food for cattle and sheep. The same authority writes as follows regarding the hard seeds enclosed in the sweet pod referred to above:—

"The seeds are very hard and in an unbroken state very indigestible. However, when split and steamed for some time, they swell out and get soft, and in this condition may be given to cattle with advantage as a useful fattening food. A sample of locust-bean kernels or seeds recently analysed by me had the following composition:—

Moisture	11·19
Oil	·97
*Albuminous compounds (flesh-forming matters)	5·94
Mucilage, sugar, and digestible fibre	76·29
Indigestible woody fibre	3·62
Mineral matter (ash)	1·99
Total	100·00
* Containing nitrogen	·95

66. Buck-wheat (*Polygonum Fagopyrum*).—A plot of 1,300 square yards was sown with this crop, the seed having been obtained from Australia. It grew well and would in an ordinary season doubtless attain maturity without being watered, but in the present case it was necessary to do so.

67. The seed was sown on November 9th, and within ten weeks the crop was off the ground, leaving it ready for another. The yield was at the rate of grain 167 lbs., straw 1,136 lbs. per acre; but, under more favorable circumstances, it would, there is every reason to believe, yield better results.

68. The crop is useful as a preparation for a cereal, or as a green manure. The fodder is good food for cows, and the grain yields, after the husk has been removed, a meal rich in nutritive matters. As an alternative crop with the cereals, as a catch crop after an early one grown for fodder, or grown as manure, buck-wheat can be recommended.

Useful Crop.

69. Flax (*Linum Usitatissumum*).—Seed of this plant also was obtained from Australia, and was sown on a piece of land adjoining the last crop referred to. It grew well, and was very healthy, but did not attain great length (only about 21 inches), as it was sown at wide intervals for the seed.

70. Vetches (*Vicia Sativa*) and Rape (*Brassica Napus*).—Australian seed—were sown, but, although the seed germinated well, neither crop succeeded. The vetches were apparently unable to withstand the heat, and the rape was attacked by caterpillars.

71. A plot of Lucerne (*Medicago Sativa*).—Australian seed—was also sown, and has done well, but as the crop was kept for seed, no outturns have been recorded of it.

72. Two samples of wheat were obtained from Egypt, but, though they germinated and grew fairly at first, no grain was produced; this may have been owing to a want of sufficient water, to a higher temperature than is usual in Egypt, and to the lightness of the soil on which the crop was sown.

73. Samples of lentils and lupins were also obtained from Egypt, but did not succeed, although they germinated well.

HEDGE PLANTS.

74. Osage Orange (*Maclura Aurantiaca*).—The plants referred to in the last report, paragraph 179, as having been raised and doing well, nearly though not totally succumbed to the last hot season, but considering the duration and severity of it, the experiment is worth continuing, and some plants raised from another supply of Australian seed are now doing well.

75. *Kangaroo Thorn.*—Some seed of this plant, which is used to a considerable extent as a hedge-plant in Australia, was obtained, and a number of young seedlings raised from it are now doing well in the nursery. The plant appears to promise well, being covered with numberless small spines, and growing fast; it remains to be proved whether the extreme heats of this country will not be too great for it, and also whether the spines are sufficiently strong to prevent cattle from straying through a hedge of it.

76. The thorny shrub, referred to in paragraphs 154 and 155 of the last report, is doing fairly well; a large percentage of the cuttings obtained grew and rooted thoroughly; but the season has been against hedge-planting, so that further trials of it have not been made. The fences planted under the system mentioned in paragraph 157 of the same report are doing well, and, notwithstanding the season they have had to contend with, have formed fences far superior to what could be obtained in so short a time, if started from seed.

SECTION II-B.

MANURES.

77. *Top-dressing experiments.*—The results given in the following table, of a set of experiments made with top-dressings during the past season, are interesting and, notwithstanding the unpropitious character of the season for such, demonstrate several points very clearly:—

—	Produce.	Unmanured.		Saltpetre. Value per Acre, Rs. 12.		Saltpetre and Bone Charcoal. Value per Acre. Saltpetre Rs. 6, Bone Charcoal Rs. 6.		Bone Charcoal. Value per Acre, Rs. 12.	
		A.	B.	A.	B.	A.	B.	A.	B.
Yield of Plot	Straw	lbs. 884	lbs. 1,348	lbs. 1,332	lbs. 1,534	lbs. 1,197	lbs. 1,402	lbs. 1,010	lbs. 1,179
	Grain	112	108	124	118	105	124	110	95
Yield per Acre	Straw	3,536	5,392	5,328	6,136	4,788	5,608	4,040	4,616
	Grain	448	432	496	472	420	496	440	776
Increase per Acre over unmanured.	Straw	..	..	1,792	744	1,252	216	504	— 776
	Grain	..	..	46	30	— 28	64	— 8	— 52
Value of Increase per Acre.	Straw / Grain	..	..	Rs. A. P. 9 1 8	Rs. A. P. 4 2 11	Rs. A. P. 3 14 8	Rs. A. P 3 6 7	Rs. A. P. 1 11 2	Rs. A. P. —5 3 2

78. The crop to which the top-dressings were applied was yellow cholum, following a heavily manured crop of maize and cotton; it was sown on 5th October, and the manures were applied on the 20th of the same month; during the whole time of growth, 193 days, there was only a rainfall of 5·74 inches in 14 days, and of this 1·59 inches fell before the 20th. The soil on which the crop was grown was a light sandy loam, not in very good condition. The seed was sown at the rate of 25 lbs. per acre and germinated well.

Good crop for droughty season.

79. It is interesting to note here that in Coimbatore District* on soils, none of which were so inferior as the one on which this crop was grown, in an ordinary season a crop of about 450 lbs. of grain is as much as can be expected per acre, which amount was attained without the use of top-dressing in this case.

80. The reason why in the B series the yield of straw should be more in every case than that in the A series, is hard to explain, excepting by the fact that the previous crop of maize had been more vigorous on the portion of the field in which the latter series were grown.

Saltpetre useful top-dressing.

81. The utility of saltpetre as a top-dressing is shown, though not so clearly as it would have been had the season been wetter and more conducive to vigorous growth; although the increased return did not recoup the value of the manure applied, it is probable that there were manural matters of more value left in the soil than are required to make up the deficiency.

* *Vide* paragraph 138 of the Report of Superintendent of Government Farms on Coimbatore District for 1876.

82. Bone charcoal by itself is shown to be useless as a top-dressing, and from its insolubility in water this might be expected; but the effect apparently caused by it in Series B must be attributed to some cause in the soil on which the plot was situated, and not to the manure applied.

Bone charcoal inert.

83. The effects of a light dressing of saltpetre, at the rate of Rupees 6 per acre, mixed with bone charcoal, were better than those obtained with a heavy dressing. And seeing that the action of bone charcoal is apparently *nil*, the increase shown must be put down solely to the saltpetre; which however, though it does not recoup the full expenditure immediately, shows that the application of a dressing of medium quantity will be more certain of being repaid in the crop produced.

Light dressing more remunerative.

84. Another set of experiments, with dissolved guano as a top-dressing was made, but, owing to a large amount of the grain having been stolen from the field, the results cannot be reported; judging, however, from the yield of straw on the different plots this manure does not materially increase that portion of the produce.

Set of experiments ruined by pilfering.

85. Lime (*Calcium Carbonate*).—The use of this mineral as a manure in native agriculture is totally overlooked, and perhaps fortunately so; for if the ryot knew the stimulating qualities of a dressing of lime on the soil, he would soon deprive it of the small reserves of plant-food it contains, and leave it utterly barren. The mineral is easily obtainable in many localities and might be applied to some soils with great advantage, but it is not to be recommended for use except under enlightened management, for it has long been said of lime that "it enriches the father and impoverishes the son," in this referring to the use of it in excess. As a manure for leguminous crops it is very valuable; and its effects, on a crop of ground-nuts grown on the farm, were most marked, for it increased the yield of nuts 83 per cent. and that of straw 10 per cent.

Not used in native agriculture.

Great effect on crop of ground-nuts.

SECTION III-A.

LIVE STOCK.

86. *Cattle.*—To form a commencement of the stock-breeding experiment, referred to in paragraph 46 of the last report, four young bulls and three heifers were obtained in November from the Amrhut Mahal herds. The cattle of these herds are chiefly noted for their qualities as draught animals. The specimens received, which were selected ones, are of slight make and very deficient in depth and thickness, but from their activity are able to perform light work with rapidity.

87. Owing to the drought it was impossible to lay down the land under guinea grass which it had been intended to; and even had means been available for keeping good stock on the farm, the presence of the Commissariat slaughter-houses in its midst renders such a proceeding unadvisable, from the risk that would be run of importing disease into the herd.

Stock-breeding experiment delayed.

88. *Measurements of Cattle.*—The following table gives the measurements of some of the cattle of different breeds that are among the farm stock; and it should be borne in mind that all the cattle were rather low in condition when measured, excepting the old Aden bull.

Breed.	Age.	Height.				Girth.		Length.		Length of face.	Breadth between eyes.	Horns.			Weight.
		Behind hump.	At loins.	At set on of tail.	To breast bone.	Behind shoulder.	At flank.	From point of shoulder to buttock.	From nose to set on of tail.			Girth at bare.	Width between.	Length.	
		ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	lbs.
Half bred bull { Nellore / European. }	Aged.	4 8	4 8½	4 6	1 11	6 3	6 11	4 4	9 3	1 11	1 0	0 9	0 7	0 11½	1,150
Aden bull	do.	4 0½	4 3	4 1	1 9½	5 8½	5 9	4 3	8 4	1 7½	0 9	0 7	0 5	0 4½	847
Do.	3	3 7	3 9½	3 6	1 6	5 0	4 10	3 9½	7 9	1 8	0 9	0 6½	0 6	0 3	521
Do.	2	3 7½	3 10	3 7½	1 7	4 8	4 8½	3 7	7 0	1 6	0 9	None present.			491
Mysore bull "dark"	6	4 1½	4 2	4 0	1 11½	5 4	5 8	4 ½	7 5	1 11	0 9½	0 11	0 2	1 5½	662
Do. "light"	6	3 11½	4 1½	4 0	1 7	5 3	5 5½	4 1	7 9	1 9	0 10	0 11	0 3	1 3	654
Do. "black"	4	3 8	3 10	3 9	1 10	4 5½	4 6	3 8	7 2	1 9	0 8	0 10	0 2	1 3½	360
Do. "speckled" ..	4	3 7	3 10	3 7	1 9	4 1½	3 11½	3 2	6 2	1 7	0 8½	0 8	0 2	1 0	290
Buffaloe bull "Guzerat black"	Aged.	4 7	4 6	4 3	1 9	6 9½	7 4½	4 5	8 9½	1 9½	0 11	1 2	0 10	1 2	1,219
Do. "Guzerat brown"	do.	4 7	4 7	4 3	1 9	6 3	6 6	4 4	8 8	2 0	0 10½	1 2	0 10	1 2½	911
Aden cow	do.	3 7½	3 9	3 5	1 8½	4 8	5 3	3 10	6 9½	1 6½	0 7½	0 5½	0 4	0 3½	490
Mysore heifer	4	3 6½	3 9	3 10	1 9	4 8	4 6	4 1	6 6	1 8	0 8	0 8½	0 2½	0 1	440
Do.	5	3 6½	3 11	3 10	1 9	5 1	5 0	3 11	6 10	1 8½	0 8½	0 8½	0 2	1 4	430

89. In all the cattle it will be observed that they stand higher at the loins than behind the hump; this may be an advantage for draught purposes, by enabling them to throw more weight against the yoke.

Fore quarters low.

90. The length of leg, in proportion to the depth of barrel, is brought out very clearly by the measurement of the height to the breast bone, and is an excessive and general defect in the cattle of the country. To further demonstrate this point, the table below gives the comparison in several instances:—

Excessive length of leg.

—	Black Bull.	Old Aden Bull.	Six years old Mysore Bull, dark.	Six years old Mysore Bull, light.	Black Buffalo.
Total height	100	100	100	100	100
Height to breast bone ..	41	44·3	47·2	40	38·2

From these figures the legginess of some of the Mysore cattle may be seen, and also the depth of barrel of the buffalo bull.

91. In the following table the height of several animals is compared with their girth, and it will be seen that, though the Aden bull is rather leggy, he is also of good girth, showing that his barrel is round, and that he is *thicker through in proportion* to his size than either the light-colored Mysore bull or the half-bred black bull:—

—	Black Bull.	Aden Bull, aged.	Mysore Bull, 6 years, dark.	Mysore Bull, 6 years, light.	Black Buffalo Bull, aged.
Height	100	100	100	100	100
Girth	130·3	141·2	128·6	132·6	149

92. It is further interesting to note that the girth of the Aden bull, which is comparatively speaking considerable, when contrasted with that of English breeds, shows how small the cattle of the country really are. As an instance, it may be quoted that the prize bull-calves of the Devon, Hereford, and Short-horn breeds, shown at Warwick in 1859, girthed 5 feet 1 inch, 6 feet 1 inch, and 5 feet 9½ inches respectively; the animals from which these measurements were taken were of course in high condition, but, when their age is considered, the contrast is very marked.

Girth compares badly with that of English breeds.

93. *Sheep.*—The management of the sheep flock has been the same during the past year as formerly, and has been most successful. The percentage of deaths, as shown by the following table, is remarkably low, for it will be seen that, with a flock nearly one-fourth larger than the average of the past three years, the death-rate has been less than half as great:—

Death-rate very low.

—	1873-74.	1874-75.	1875-76.	1876-77.
Average number of flock ..	207	221	237	275
Number of deaths ..	16	24	21	11
Percentage of deaths ..	7·73	10·9	8·9	4
Rainfall of year	48·07 inch.	68·98 inch.	38·14 inch.	20·88 inch.

94. The influence of the rainfall on the death-rate is very great; and in a dry year like the past one, as long as sufficient food could be provided for the sheep, the absence of those disorders of the bowels caused by eating the hastily-matured grass, which grows so rapidly during the usual monsoon rains, keeps it low. In 1874-75, which year was marked with the heaviest rainfall of the four referred to in the table, it will be

Absence of rain good for health of sheep.

noticed that the death-rate was highest, which is attributable to the presence of the disorders before mentioned.

95. The following table brings out many interesting facts regarding the condition of the flock as at present constituted:—

Rams.				Ewes.			
No.	Age.	Average Weight.	Average Yield of Wool.	No.	Age.	Average Weight.	Average Yield of Wool.
38	Lambs	28 lbs.	Not shorn.	27	Lambs	25·6 lbs.	Not shorn.
31	Shearling ..	47 ,,	1·76 lbs.	34	Shearling	39·6 ,,	1·6 lbs.
16	2 Shear	66 ,,	2·28 ,,	23	2 Shear	48 ,,	1·77 ,,
8	3 Shear	69·13 ,,	2·25 ,,	6	3 Shear	48·3 ,,	1·58 ,,
15	Aged	69·7 ,,	1·78 ,,	78	Aged	53·55 ,,	1·29 ,,
70	Average	58·74 ,,	1·94 ,,	141	Average	49·05 ,,	1·45 ,,
					Average of 211 sheep of all ages ..	52·27 lbs.	1·62 lbs.

96. These figures show that the rams, excluding this year's lambs, averaged in weight 9·69 lbs., or 16·5 per cent. more than the ewes; the greatest difference in weight being in the shearlings, where the rams are as much as 37 per cent. heavier. It also shows that up to the age of 2 years the sheep increase considerably in weight, but that after that age there is very little material alteration.

97. As might be expected, seeing that early development is generally the most rapid, there is a greater difference between the weights of the shearlings and the lambs than between that of the sheep of any other two consecutive years; in this case the shearling rams are 68, and the shearling ewes 55 per cent. heavier than the ram and ewe lambs respectively, whilst the 2 shear are only 40 per cent. heavier than the shearling and 4½ per cent. lighter than the 3 shear rams, and the 3 shear ewes are almost the same weight as the 2 shear, and the latter only 21 per cent. heavier than the shearlings. These facts only show how necessary it is to give strong nourishing food to sheep under 2 years of age, if it is desired to obtain well-formed and well-grown stock.

Quality of wool improved.

98. The wool produced this year shows on the whole an improvement in quality, and the sheep are far better covered, there being an absence of the bare necks and breasts that were formerly so common. The value of the wool in the local market has increased considerably, for instead of only 1½ Annas per pound, the rate obtained in 1871, this year 2½ Annas were realized, showing an increased value of 66 per cent. The amount of yield per sheep does not average quite as high as a clip did in 1871, when 120 sheep averaged 1·81 lb.; this is probably due in a great measure to the scarcity of grass with which this season has been characterized, whilst the number shorn is in this case nearly double.

Yield for weight good.

99. Returning again to the table given in paragraph 95, it will be seen that for every 10 lbs. of live weight, the sheep produced on an average 4·95 ounces of wool, an amount which compares not unfavorably with that yielded by the English short-woolled breeds of sheep. In the following table the yield of wool per 10 lbs. live weight of the different sexes at various ages is given:—

—	Shearlings.	2 Shear.	3 Shear.	Aged.	Average.
	oz.	oz.	oz.	oz.	oz.
Rams	5·99	5·53	5·21	4·09	5·28
Ewes	6·46	5·90	5·23	3·85	4·73

100. This table shows that of the whole flock the shearlings clip heaviest for their weight; and that as the sheep develope, the yield of wool does not increase in propor-

tion to their size. The greatest yield of wool is apparently given at the age of 2 years, increasing up to that age, and remaining stationary or lessening after, both in the case of the rams and of the ewes.

101. *Poultry.*—The fowls and ducks, referred to in paragraphs 49 and 50 of the last report, have had in general perfect health, but amongst the chickens and ducklings there has been a great mortality. The Pekin ducks after laying almost continuously for nearly six months ceased, and have not again commenced to lay to any extent, the extreme heat having apparently been too great for them, as they have never recovered, although their general health has been good.

102. The following poultry and eggs have been sent to different parts of the Presidency during the year :—

—	Poultry.	Eggs.
Brahma Dorking	48	146
Half-bred Fowls	25	146
Ducks	9	19
Total ..	82	311

103. The poultry yard was rearranged, extended, laid down in turf, and planted with shade trees; these arrangements will conduce greatly to the health of imported fowls as well as young chickens, the temperature of the yards being much lower and the poultry protected from the sun.

SECTION III-B.

FOODS AND FEEDING.

104. *Feeding.*—In selecting food for any kind of stock, the following points must be borne in mind; the species and age of the animal to be fed, and the object with which it is being fed.

Conditions and objects must be known.

105. Thus, the ox can digest more woody fibre in a food than the sheep, whilst the pig seems incapable of digesting it at all; cattle from the size of their stomachs require a bulky food, and a considerable amount of water; sheep, on the contrary, do not require so large an amount of food, nor do they require so much water, in proportion to their size.

106. The pig has been proved to make the most use of his food in assimilating it into his structure, and thus fattens easily and quickly, and repays the use of rich foods.

107. If animals are young and in a growing state, they require a larger and more concentrated supply of food for their size than older animals. They require a more highly nitrogenized food for the development of their tissues; and they extract from it a larger amount of its mineral constituents for the formation of their bones, &c.

108. In fattening cattle and sheep, when the wear and tear is reduced to a minimum, and the object is to increase the amount of flesh and fat, substances rich in oil, starch, gum, sugar, &c., produce the best results.

109. Milch cattle should always be liberally fed with green fodder, as it causes an increase in the quantity of the milk produced. If the production of butter be the object in view, the use of foods containing a high percentage of oily matters has an effect in increasing the amount. Should cheese be the desideratum, the use of leguminous crops, such as gram, owing to the fact that cheese is chiefly composed of casein (the nitrogenous part of milk), will cause an increase of the constituent required.

Green fodder good for milch cows.

FOODS.

110. *Chaffing.*—The practice of chaffing fodder for cattle has been regularly practised here with the best results. It is a most economical arrangement in preventing waste, which always occurs when cattle are fed on long straw. It enables cattle to be kept in good condition on a smaller allowance of food, as they do not tread into manure any appreciable amount of chaff, and also as their food is in a finer state of division, the cattle are able to assimilate more of what they eat.

Chaffing most beneficial.

111. *Ground-nut Cake*—is still the auxiliary food used; and although, as has been the case with all other food stuffs, there has been a very great rise in the price of it, it still remains the cheapest food procurable. In 1870, this cake was obtainable at the price of about 90 lbs. per rupee, at the commencement of the present year, the rate paid for it was about one rupee for 73 lbs., or an increase in price of nearly 19 per cent.; this may be attributed to the increased demand of the cake for export. The contractor who was supplying the cake, failed to fulfil his contract after December, and since then cake has been obtained in the open bazaars at an average price of about one rupee for 45 lbs.

Great rise in price.

112. The value of the cake as a feeding stuff has already been clearly shown, and the longer it is used the more valuable does it prove. The following analyses of the oil-cake made from the ground-nut are interesting:—

Most valuable feeding stuff.

Constituents.	Professor Church.		Professor Tuson.*		Dr. Vœlcker.	Dr. Anderson.	Average Composition of Linseed Cake.
	Decorticated.	Undecorticated.	Decorticated.	Undecorticated.		Average of two.	
Moisture	9·3	8·1	9·58	9·28	10·80	10·84	12·0
Oil	5·6	8·8	7·40	6·99	8·12	9·80	11·5
Albuminoids	43·4	30·5	42·81	32·81	28·62	30·33	29·7
Carbo-hydrates	31·4	27·8	27·63	23·67	18·86	45·50	27·8
Indigestible fibre ..	5·2	19·1	7·87	23·80	29·09		12·0
Ash	5·2	5·7	4·71	3·45	* 4·51	† 3·53	‡ 7·0

* Containing sand 1·4. † Containing phosphates 1·15, phosphoric acid ·80.
‡ Containing potash 1·65, phosphate of lime 4·92.

113. Judging from the analyses, given by Professors Church and Tuson, of cakes made when the seed is husked and unhusked, those of Dr. Vœlcker and Dr. Anderson referred to samples of undecorticated cake. Comparing the analyses with that of a sample of linseed oil-cake given by Dr. Vœlcker, the cake will be seen to be not quite so rich in oil and therefore not so well adapted for fattening purposes, but, as the means of expressing the oil from the seed in this country are very inadequate, in all probability the percentage of oil is much higher, so that this objection disappears; the high percentage of nitrogenous matters explains why it is so useful a food for working cattle.

114. Further it may be observed that the high percentage of nitrogenous compounds in the cake causes great increase in the value of the manure made by animals fed on it; for it is calculated by the best authority on the subject, Mr. J. B. Lawes, of Rothamstead, that the loss of nitrogen in the consumption of cake is about one-tenth of that which it contains, the rest passing off in the manure.

Cake fed increases the value of manure.

115. The ground-nut cake met with here is always decorticated; the husks are used as fuel, and the ashes therefrom, which amount to ·7 per cent. of the total crop, are generally thrown away; which, as the following extract shows, is a most wasteful practice:—

"The ash of the seed consists of salts wholly soluble in water, they being phosphates of the alkalies, with traces of alkaline chlorides and sulphates. The phosphoric acid is chiefly united with potassa. The ash of the husk differs in containing chiefly common salt, and phosphates of lime and magnesia."

SECTION IV.

IMPLEMENTS, MACHINES AND TOOLS.

116. *Swedish Ploughs.*—It was stated, in paragraph 191 of last year's report, that arrangements had been made to obtain some specimens of iron ploughs of Swedish manufacture; early in March, 28 specimens of 14 different descriptions of ploughs were received.

All swing ploughs.

117. In construction and in form, excepting Nos. 9 and 29, they present no very marked peculiarities; all of the ploughs are swing ploughs, and as such are open to the objection, common to such implements, of being difficult to manage. This defect can be however easily remedied, and, in the trials the ploughs were subjected to, a wheel was fitted on all.

Cheap implements.

118. The cost-price of these ploughs delivered at Madras averaged about Rs. 33, which, considering the substantial manner in which they are put together, is very moderate.

119. All the ploughs are made either of wrought iron, cast iron, or steel in their different parts. The stilts and beams are in all cases made of wrought iron; Nos. 1, 2, 12, 16, 37 and 38, have trussed, the others simple beams. Excepting in the case of Nos. 29 and 34 the bodies are made of cast iron, whilst in the two ploughs referred to wrought iron is used. The slades are in every case cast, whilst the shares are all wrought iron. Steel mould-boards are fitted to Nos. 27, 29, 30, 34, 37, 38, 39, and 40, and those of the rest are cast iron.

120. In No. 9 a plan, which is totally inapplicable to the construction of machines for this country, and of doubtful economy anywhere, is adopted; the body, slade, and mould-board, are cast in one piece, thus increasing the risk of breakage, and the cost of repair if an accident occurred; to this method of construction, the general objections to castings, urged in the report for the year 1874-75, paragraph 135, are particularly applicable.

121. No. 29 is a very small plough; exceedingly light and short, tolerably efficient, but its peculiarity lies in one stilt being dispensed with, the solitary one, however, is fitted at the top with a cross-piece on which two handles are fixed.

122. In the following table the results of a trial of the ploughs, has swing ploughs, are given :—

Plough.	Furrow.			Draught.	Comparative Efficiency.	Weight without Wheel.
	Average.		Cubic Yards of Soil moved in 144 yards run.			
	Depth.	Width.				
	INCHES.	INCHES.	C. YARDS.	LBS.		LBS.
Ransome's	4	10	4·4	175	100	88
No. 30	4·5	14·75	7·375	315	92·18	147
,, 34	5·25	10·25	5·98	259	90·91	79
,, 39	5·00	12·00	6·6	322	81·52	126
,, 37	4·875	13·5	7·31	385	74·78	156
,, 27	4·5	12·25	6·125	343	70·31	126
,, 9	4·31	12·75	6·11	343	70·14	126
,, 3	6·00	11·00	7·3	420	68·75	133
,, 29	4·5	9·75	4·875	280	68·55	71
,, 40	5·0	10·75	5·97	343	68·53	126
,, 38	4·81	10·75	5·74	392	57·66	150
,, 2	4·81	10·75	5·74	392	57·66	167
,, 12	4·25	13·25	6·26	434	56·79	223
,, 16	4·125	12·5	5·74	420	53·81	185
,, 1	3·75	10·00	4·16	333	49·27	173
Average of 14 Swedish Ploughs	..	..	6·099	355·8	67·49	142

123. The Ransome's plough referred to in the table was not a swing plough so that the comparison is not complete, but still the excessive draught for work done is very clear, and when this is considered in addition to the difficulties of managing a swing plough, it is evident that as such the Swedish ploughs on the whole are not to be compared with the wheel ploughs of the English make.

124. To see whether if fitted with a wheel these ploughs would be found to have any comparative merits, the trials, of which the following are the results, were made :—

Plough.	Furrow.			Draught.	Comparative Efficiency.	Weight with Wheel.
	Average.		Cubic Yards of Soil moved in 144 yards run.			
	Depth.	Width.				
	INCHES.	INCHES.	C. YARDS.	LBS.		LBS.
Ransome's	3·75	9	3·75	175	100	88
No. 39	4·5	11·875	5·9375	273	101·49	137
„ 29	4·5	11·5	5·75	273	98·29	82
„ 40	4·5625	11·125	5·64	273	96·41	137
„ 27	3·8125	10·75	4·55	224	94·79	137
„ 3	4·625	9·125	4·69	231	94·74	144
„ 12	4·4375	11·625	5·757	294	91·38	234
„ 34	4·0000	10·125	4·5	231	90·91	90
„ 37	4·125	12·5	5·729	329	81·26	167
„ 2	4·0000	10·75	4·7	294	75·84	178
„ 1	4·3125	11·125	5·33	336	74·03	184
„ 9	4·4375	7·875	3·88	245	73·80	137
„ 30	4·0625	10·75	4·85	329	68·79	158
„ 38	4·0625	10·625	4·525	315	67·00	161
„ 16	4·5	10·5	5·25	378	64·82	196
Average of 14 Swedish Ploughs	..	..	5·0833	287·5	82·515	153

Although, because the two sets of trials were performed at different dates and in different fields, and that during the period which elapsed between them the land had become considerably drier, the outturn of work for draught on the two occasions cannot be fairly compared, yet, seeing that the same Ransome's plough was tested in both cases, it is fair to conclude that a proportionate increase of draught for work done would take place in all the ploughs, owing to the different conditions under which the two trials are conducted. The Ransome's plough whilst registering the same draught in both cases, on the second occasion moved 15·60 per cent. less soil in a given distance.

125. Bearing the above-mentioned fact in mind, the decrease in draught, shown in the trials after a wheel had been added, must be attributed solely to that addition; the average decrease of draught in the ploughs is 68·3 lbs., or 19·2 per cent., and from this the usefulness of a wheel may be easily judged

A wheel effects the draught to a great degree.

126. The effect, however, that the wheel had in lessening the draught varied very much in every case, and there were two remarkable exceptions to the rule, viz., Nos. 30 and 34; the former displayed less than and the latter the same efficiency as compared with Ransome's plough when used as swing ploughs, showing clearly that these two implements can be used comparatively advantageously as such. The effect of the wheel in Nos. 9, 16, 37, 38 was very small, but still sufficient to recommend the addition.

For land similar to that of trials heavy ploughs not suited.

127. These trials have shown very clearly that, for such work as they were doing at the time of trial, the lighter ploughs were far more effective, both when fitted with wheels and when used as swing ploughs; this may be partially accounted for by the fact that, draught equal to about three-fourths of the gross weight of a plough is consumed in moving it when it is doing no work, and also because the heavier, that is larger, ploughs are better adapted to deeper work, or for ploughing stiffer soils than those on which they were tested. The following table shows the points referred to:—

—	Without a Wheel.		With a Wheel.	
	Seven lightest.	Seven heaviest.	Seven lightest.	Seven heaviest.
Average gross weight	112 lbs.	172 lbs.	123 lbs.	183 lbs.
Average soil moved in 144 yards run	6·15 c. yds.	6·05 c. yds.	4·99 c. yds.	6·17 c. yds.
Average draught	330 lbs.	382 lbs.	250 lbs.	325 lbs.
Comparative efficiency	100	85	100	80
Comparative efficiency deducting from draught ¾ of gross weight.	100	95	100	86

128. Another point has been shown by this experiment, that is, that the friction on a steel or cast-iron mould-board does not differ sufficiently to form an item in the draught; the extra weight, however, of the cast-iron mould-board is objectionable, and the following table demonstrated the facts referred to very clearly:—

—	With a Wheel.		Without a Wheel.	
	Eight Ploughs.	Six Ploughs.	Eight Ploughs.	Six Ploughs.
	Mould-board, steel.	Mould-board, cast-iron.	Mould-board, steel.	Mould-board, cast-iron.
Average gross weight	123 lbs.	168 lbs.	134 lbs.	179 lbs.
Average draught	330 lbs.	360 lbs.	281 lbs.	296 lbs.
Average soil moved	6·25 c. yds.	6·56 c. yds.	5·925 c. yds.	4·947 c. yds.
Comparative efficiency	100	96·24	100	79·26
Comparative efficiency deducting from draught ¾ of gross weight.	100	106·74	100	93·24

129. *Water-lifts.*—No new machines have been experimented with during the year. The double mhote, so often referred to in these reports, continues to give most satisfactory results. The chain-pump, referred to in paragraph 184 of the last report, has also worked with fair results, but the expense of repairs on it is very great.

SECTION V.

DISTRIBUTION OF SEEDS.

130. During the past year the following seeds have been distributed to the districts mentioned in the following table:—

	Maize.	Sorghum Saccharatum.	Planter's Friend.	Yellow Cholum.	Carolina Paddy.	N. O. Cotton-seed.	Egyptian Cotton-seed.	Tobacco-seed.	Jute-seed.	Wheat.	Corcapilly-seed.	Sundries.
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	OZ.	LBS.	LBS.	LBS.	
Ganjam	50	50	50	..	..	..	..	..	..	..	..	..
Vizagapatam	5	15	55	..	..	..	..	..	10	..	..	..
Godavery	30	30	20	..	..	..	..	7 oz.	..	..	..	..
Kistna	20	20	20	..	..	..	..	..	..	..	..	..
Nellore	...	100	23	..	..	25	..	..	..	..	..	..
Cuddapah	50	..	..	..	..	..	..	..	..	..	..	..
Kurnool	20	..	..	..	..	..	..	..	..	..	..	..
Bellary	10	100	100	..	..	..	..	..	..	..	..	..
North Arcot	20	20	20	..	..	..	..	1 oz.	..	..	..	..
Madras	..	90	45	..	..	50	10	..	..	..	..	..
Chingleput	87	15	5	..	235	10	..	..	..	10	..	..
South Arcot	50	25	..	..	..	100	..	..	..	..	..	..
Salem	80	72	30	..	..	..	..	..	..	..	..	..
Coimbatore	5	..	..	..	..	..	..	6 oz.	..	..	..	..
Trichinopoly	65	5	5	5	..	..	..	4 oz.	..	..	..	..
Madura	5	25	10	..	..	5	..	11 oz.	..	..	5	..
Tanjore	5	¾	½	..	..	..	..	..	..	..	..	..
Tinnevelly	15	80	70	..	95	20	..	..	..	..	..	..
Malabar	100	65	80	..	..	½	½	..	..	..	..	..
South Canara	52	10	5	10	..	..	..	..	..	..	..	..
Nilgiris	..	100	50	..	..	..	..	..	..	..	..	27 packets.
Mysore	..	10	10	..	..	..	..	..	..	..	..	2 do.
Travancore	16	20	35	..	5	10	..	..	..	..	..	..
Bombay	10	10	..	..	..	100	..	..	..	..	..	..
Rajputana	4	..	..	..	..	..	..	..	..	..	..	9 packets.
Total ..	700	862¾	633½	15	335	320½	10½	1 lb. 13 oz.	10	10	5	38 packets.

131. The tobacco-seed referred to was imported, under the orders of the Board of Revenue, from Australia; but very few applications, as will be seen, were made for it.

SECTION VI.

IMPLEMENT WORKSHOPS.

132. During the past year, besides the implements mentioned in the accompanying table being manufactured for sale, a large amount of repairs of tools, &c., for the farm, the furniture for the School of Agriculture, and various models of water-lifts, &c., for distribution were made:—

Districts to which sent.	Iron Ploughs.	American Ploughs.	Combined Ploughs.	Jointed Harrow.	Drill Sowing Machine.	Planters' Hoes.	Reaping Knives.	Winnowing Machine.	Chaff Cutter.
Coimbatore	..	1	..	..	..	..	..	..	..
Mysore	8	3	3	..	..	..	..	..	..
Tinnevelly	1	1	..	1	1	12	12	1	1
Coorg	..	1	1	..	..	..	..	..	..
Bellary	..	..	..	..	..	..	..	..	1
Nilgiris	..	..	..	..	..	..	..	..	1
Madras	..	2	..	..	..	..	..	..	..
Total ..	9	8	4	1	1	12	12	1	3

133. A plough very similar to the American one, referred to in paragraph 138 of the report for the year 1874-75, has been made in the shops, costing about Rupees 20; several modifications, of the model imported from America, materially affecting the efficiency of the plough, were made. It is the American plough referred to in the table given in the preceding paragraph.

134. The following is a statement of the transactions of the shops during the year:—

Expenditure.		Income.	
	Rs. A. P.		Rs. A. P.
Plant	2 11 0	Machines	915 13 0
Labor, &c. ..	1,066 10 8	Materials, labor, &c.	1,423 14 2
Materials, &c. ..	877 2 4		
Total ..	1,946 8 0	Total ..	2,339 11 2

135. The next statement shows the financial condition of the shops. It will be seen that the deficiency, since their commencement in 1871, has been slightly reduced during the year; the reduction would have been greater had the plan formerly pursued, of calculating the valuation of the plant, been adopted, instead of taking the actual valuation.

Balance Sheet of Implement Workshops on 31st March 1877.

Liabilities.			Assets.		
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Capital—			Valuation—		
Advanced 1870-71	883 1 5		Buildings	419 15 3	
Do. 1871-72	213 1 2		Plant	243 5 0	
Do. 1872-73	1,077 3 2		Materials	51 6 0	
Do. 1875-76	219 4 11		Implements for sale ..	283 0 0	
	2,392 10 8				997 10 3
Repaid— Rs. A. P.					
1873-74 .. 213 10 5			Outstanding bills	..	306 2 3
1874-75 .. 122 15 9			Deficiency	..	514 15 2
1876-77 .. 393 3 2					
	729 13 4	1,662 13 4			
Outstanding bills	..	155 14 4			
Total ..	..	1,818 11 8	Total ..	..	1,818 11 8

SECTION VII.

ESTATE.

Area.

136. The area of the farm estate remains unchanged, for, although the new site for the Commissariat Slaughter-houses was given over, when funds were found to be unavailable for carrying out their much-to-be-desired removal, it was retransferred.

Trespass nuisance.

137. The removal of the wudder village has lessened the trespass we suffer from, but until the slaughter-houses are removed, and Roshunbaughum village is fenced or walled in in a manner that will prevent it, the nuisance must continue to be very great.

Satisfactory experiments will be possible in the future.

138. The many difficulties in the way of carrying out experiments in a satisfactory manner are rapidly disappearing, now that the requisite estate improvements are nearly completed; and as soon as the whole land within the boundaries of the farm is given over to it,

and trespass can be prevented, they will be removed. Now that so much of the land has been levelled to a moderate slope, the detrimental influences of an excess of water, either running or stagnant, will be removed; the effects of manuring will be more permanent and marked, and the desired evenness of quality of soil will, it is hoped, be obtained.

PERMANENT IMPROVEMENTS.

The estate improvements carried out during the year, under the superintendence of Mr. Schiffmayer, comprise, amongst others, the re-arrangement and extension of the farm buildings, including a duck-house for the reception and acclimatization of exotic breeds, a new sheep-shed, an extension of the barn to form a cake-room, and several minor works; a large area of land being levelled and arranged in such a manner as to admit of the existing wells and channels being utilized; the extension and deepening of the irrigation channel, referred to in paragraph 26 of the report for the year 1872-73; the excavation of a new channel on the western side of the farm to bring the water from the Adyar to the central portions of it where it will be raised for irrigation purposes; laying out and partially completing a new main drive running through the farm from east to west, and building a lodge at the western entrance gate; laying out a portion of the experimental botanical grounds for the Agricultural College; planting several acres of the poorer soils with casuarina and other trees; and working the tile-yard, where a number of bricks for the new buildings, drain-pipes, and other articles were manufactured.

Buildings.

Levellings.

Irrigation Channel.

Road.

Planting.

Tile-yard.

(Signed) CHARLES BENSON, M.R.A.C.,
Superintendent of Sydapet Farm.

SYDAPET,
August 27th, 1877.

WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

THE AGRICULTURAL COLLEGE.

In my last Annual Report, I noticed briefly, this new institution. It seems desirable that a fuller account of the circumstances that have led to its establishment should be placed on record.

Sydapet Farm Apprentices.

2. Almost from the time the Sydapet Experimental Farm was first opened, it had attached to it a number of Apprenticeships, which were filled by Eurasian and Hindu youths. Up to 1871 there was only one class of these Apprentices. These youths were afforded only such training as could be had from taking part in the ordinary operations of the farm. Each Apprentice began on a monthly salary of Rupees 15, which was increased annually, on good conduct, until Rupees 25 per mensem was reached. All were provided with free quarters. In 1871, it having been determined to start a number of District Farms, another class of Apprentices was established, in view to provide Superintendents for these new farms. To these Apprenticeships liberal salaries (Rupees 40 each per mensem) were attached, in order to induce young men of good social position to offer themselves for training. The class was filled, but not with men of the stamp it was hoped to obtain; indeed, all the inducements offered failed in securing anything like a competition for the apprenticeships and only two or three were filled by men of a fairly good social position, while none of those appointed were educated men. This class was filled by Hindus and Mahomedans. The training to which these youths were to be subjected was similar to that of the youths in the other class.

District Farm Apprentice Class.

Unsatisfactory conditions under which placed.

3. References were frequently made in my Annual Reports, to the very unfavorable conditions under which these youths were placed for gaining a knowledge of agriculture. The progress made by one or two of the youths was certainly fair, bearing in mind the difficulties they had to contend with, but the general results were unsatisfactory; the means employed were clearly quite inadequate for training men to fill the posts of District Farm Superintendents. On this subject, in a letter, No. 414, of the 28th of May 1872, I addressed the Board of Revenue as follows:—

"The arrangements for training and educating Farm Apprentices need much fuller consideration. If we are to turn out really competent Superintendents, men who will be able to train youths on the local farms, and who will be worth to Government from 150 to 250 Rupees per mensem, it is evident that we must go about our work in a *very thorough and systematic* manner, or the three years allotted for training, &c., will not nearly suffice. It is of the utmost importance that *we should now* come to a clear and definite understanding, as to the course to be pursued in training these apprentices. Fortunately, agricultural training is no new experiment; we have before us the results of many years' experience, in the training of agricultural pupils in America, on the Continent of Europe and in Great Britain and Ireland. It is true that the social habits of the people of this country are altogether different to the habits of the people in any of the countries I have named, while their agricultural practice is equally peculiar, rendering it necessary that our work, to a certain extent, should be experimental; still there is much in the experiences of other countries that may serve, to warn us as to the dangers to be avoided, and indicate the general direction towards which our endeavours should tend. The system under which agricul-

tural pupils are trained in Ireland is, I believe, the most suitable for such a country as this, peopled with poor cultivators holding very small areas of land. This system undoubtedly has its faults, but these are unimportant in comparison with the vast benefits it confers. Under the Irish system, agricultural schools, of different grades, with small farms attached, are equally distributed over the country; in the schools the pupils receive a good literary and agricultural education. These schools are the feeders of the central institution, to which the best pupils, after qualifying, are sent to complete their agricultural training, at the entire expense of Government. These pupils become the Superintendents of the local farms and agricultural schools, farmers, stewards and bailiffs, and thus sound agricultural knowledge is gradually extended over the country.

"In the Madras Presidency this system would work admirably. A central farm, with branch local farms, already forms part of our scheme. The apprenticeships of 40 Rupees each per mensem, to be created for each projected farm, might be turned into scholarships, to be awarded to the most competent pupils, after a sufficient time had elapsed to admit of their progress being determined, all students thus entering at a uniform allowance of 15 Rupees a month under the terms of G.O., No. 1,041, dated 13th June 1871. The students to be either Natives or East Indians, and all to undergo an entrance examination, to be similar to that for admission into the Engineering College, or the subordinate ranks of the Medical Department. The course of training to extend over three years, during which time the pupil should receive a thorough practical training in the field, and a theoretical training in the lecture-room; lectures on agriculture, agricultural chemistry, botany, mechanics, veterinary surgery, &c., being delivered at stated periods; while periodical examinations should be held, in order that the progress of the pupils may be ascertained."

These proposals did not meet with the approval of the Board, or Government.

4. In my report for the year ending 31st of March 1873, I wrote as follows regarding these apprentices:—

"The general conduct of these young men while at the farm has been satisfactory, and they evince some interest in their duties, especially in those of a practical kind; all are able to work our English ploughs; indeed, two or three can plough very well. But the system is certainly not one that is calculated to train Superintendents to be placed in charge of the district farms. These young men come here ignorant of the very ABC of agriculture, and agriculture can be taught only in the way that any other profession is taught, that is, by beginning with systematic elementary instruction, and grounding the student thoroughly as he proceeds in his education. The system under which these young men are supposed to be taught agriculture is, it is true, that under which many agricultural pupils are placed in England; but little consideration is needed to enable one to see that such a system, even if beneficial in England, can be so, only under conditions *which are not met with in this country*. In England, young men who are placed for a time with a farmer to learn practical farming, frequently spend a year or more at some institution devoted to the teaching of agriculture or the sciences bearing on agriculture; and the superior practice which they are taught is no novelty. * * * * Some of these young men may in time, under the training under which they are now placed, become suited for employment as Overseers under certain conditions, and they might also under certain conditions make successful farmers, but they can never become what the District Farm Superintendents should be—local sources of agricultural information, local authorities on all relating to the agricultural practice of their districts, and the pioneers of agricultural reform."

5. In June of the same year in which the foregoing remarks were penned, the Board of Revenue were led to make more minute inquiries, as to the working of the system under which the apprentices were placed for training. The results of those inquiries are embodied in a letter, they addressed to Government, from which the following extracts are taken:—

"In their Order of the 7th April 1873, No. 397, Government agreed with the Board that the establishment of a system of agricultural education at the Sydapet Farm should be deferred as premature, but ordered that the arrangements already sanctioned should be made complete and effectual, *i.e.*, that the Sydapet Farm should be made as useful to the public as possible, and that District Experimental Farms should be instituted and provided with competent superintendents.

"In devising means for carrying out these orders, the Board have been led to make minute inquiries as to the methods pursued at the Government Farm, as to the facilities for training Farm Superintendents there, and as to the manner in which the information possessed by Mr. Robertson and his subordinates can best be disseminated. One result is that the Board's opinion, that the commencement of systematic instruction in agriculture and the sciences bearing

upon it could be and should be deferred, has completely changed. I am accordingly directed to solicit Government to reconsider the question.

"The reasons which have influenced the Board may be briefly summarised as follows:—

"(1.) That unless systematic instruction in agriculture and the sciences bearing on it is given at the Sydapet Farm, competent Superintendents for the Experimental Farms which are to be instituted cannot be trained there.

"(2.) That, without Superintendents trained in this way, the Experimental Farms will be of little or no use.

"(3.) That the means for giving such a training, the lectures, the students, the opportunities for practising what is taught, and the funds are all available.

"(4.) That the good effects of the instruction will not be limited to a few Superintendents of Government Farms, but will slowly leaven the agriculture of the whole country, as in England, America, France, and Germany.

"(5.) That as a scene of systematic instruction open to all comers, the Sydapet Farm will be infinitely more useful to the public than it is at present.

"It is easy to show that the present system of teaching Apprentices how to plough and sow and manure, &c., will not supply competent Farm Superintendents. There are two classes of Apprentices in the Sydapet Farm. One class, six in number, was formed under G.O., dated 13th June 1871, No. 1,041. They are appointed after an examination which shows that they are fairly educated, and they are paid salaries beginning at Rupees 15, and increasing in four years to Rupees 25. The class is meant to supply Overseers and subordinates, and will do this, but nothing more. The other class consists of the six District Apprentices chosen by Collectors under G.O., dated 22nd September 1871, No. 1,657, and Government now propose to raise the number from six to ten. They are paid Rupees 40, but even this high salary has not been sufficient to attract the right sort of men. It is intended that they should be superior in station to the other class and supply Farm Superintendents; but the Board are assured that there is not one of them who seems at all likely to become fit for such an employment.

"The present system must be admitted, therefore, to be unsuccessful in practice. In theory it *must* be unsuccessful; for no one, who is without an agricultural education and some knowledge of chemistry, botany, animal pathology, &c., however skilled he may be in the manipulations of the farm, will be able to vary its processes so as to adapt them to a different climate, a different soil, different crops, different breeds of cattle, and different agricultural conditions. A man who is a skilful farmer in Madras would find himself at a loss even in ordinary farming if he were suddenly placed in Bellary. The scientific principles which underlie and suggest the processes of the farm are the same everywhere, but the processes themselves change.

"But even, if by extraordinary ability a Superintendent of a Government Farm knowing nothing of scientific principles were to succeed in cultivating the farm, he would be unable to give a sensible reason *why* when he worked in a different way from his neighbors.

"It is found necessary to conduct youths who intend to be Engineers and Public Works Overseers or Doctors and Hospital Assistants through a stated curriculum, and the same thing must be done with men who are to exemplify and teach scientific agriculture. The students must go through courses of lectures in agriculture, in elementary chemistry, in agricultural chemistry, in animal pathology, and veterinary medicine, and in botany; they must verify the lessons thus taught them on the soil itself and on cattle, and they must have a fair general education to begin with.

"The Board have been in communication with the Principal of the Medical College, and are confident that lecturers, who will deliver lectures once a week on elementary chemistry, animal pathology, and veterinary medicine, and botany, can be obtained thence. The possession of a fair education can be tested by an entrance examination and supplemented by instruction in book-keeping, surveying, mensuration, &c., without difficulty.

"The expenditure on instruction thus incurred can be paid from the Surplus Pound Fund without interfering with the establishment of the experimental farms.

"The stipend of Rupees 40 granted to the District Apprentices is needlessly large, and the two classes should be on the same footing, their salaries increasing from Rupees 15 to Rupees 25, and Rupees 5 being allowed as batta to Apprentices who come from a distance. The number may then be increased, the increments of salary regulated by examination, and scholarships and prizes established without additional cost.

"The machinery thus provided will suffice not only for turning Apprentices into Overseers and Farm Superintendents, but for training a large number of private students, and if private

students are allowed to attend, the opportunities of selecting competent men for the service of the State will be greatly increased.

"For some time to come, for obvious reasons, the supervision should be left to the Board and not entrusted to the Educational Department. This is in accordance with the practice of several of the States of Germany where the Agricultural Colleges are under the Minister of Agriculture, and of America where the Board believe that agricultural education is supervised by the Commissioner of Agriculture.

6. In order that the matter might be laid fully before Government, I was directed to submit my views to the Board on the whole question of agricultural education. This I did, in a letter, dated the 14th of October 1873; from this letter the extracts that follow are taken:—

"The time seems now to have arrived for a commencement to be made in this Presidency in systematic agricultural education. Our literary institutions are turning out annually large numbers of fairly-educated young men, many of whom have a very uncertain future before them, and amongst these we might expect to find no inconsiderable number who naturally belong to agriculture, and who would readily undergo a systematic agricultural training. In this way an Agricultural College *would aid in restoring the balance* which the undue facilities for obtaining a mere literary education, have so greatly disturbed. At present our schools and colleges *are drawing from agriculture the best of her men*; if this is allowed to continue, our degraded husbandry will only become the more degraded. We have established a Medical and an Engineering College, neither of which can possibly confer on the country a tithe of the benefits that would result from the existence of a well-organised, well-supported Agricultural College.

"We have wasted much time, and large sums of money, in the hap-hazard, unsystematic way in which we have endeavoured to bring about some improvement in the husbandry of the people. We cannot longer continue to deal with our agriculture in the way we have dealt with it heretofore; surely the enormous mass of evidence now available amongst the records of the Government of this Presidency, regarding the results which have attended the spasmodic and very unsystematic efforts to effect some improvement in native farming, is sufficiently convincing, and this evidence is conclusive, as to the unsatisfactory character of the results. And, such being the case, it is abundantly evident that we must either retire altogether from all active exertions, on behalf of the improvement of our husbandry, or we must apply our efforts in some other direction and in a way somewhat different.

"It is admitted in all civilised countries that, while the ownership of land confers rights and privileges, it also creates duties, and not the least of these is a responsible stewardship on behalf of the people, their interests being effected for good or for evil through a fall or a rise in the prices of the necessities of life, as the duties arising out of this trust are well or are ill-performed. Now, in this Presidency the duties created by the ownership of land naturally devolve on Government, as in most districts Government is the chief land-owner; though undoubtedly these duties and responsibilities should be shared in by the other owners of land, whose position will most certainly be bettered by any well-organised, well-directed effort to promote our agriculture. But, if this view of our responsibility is not deemed to be sufficiently weighty to justify Government in at once inaugurating a complete and efficient system of agricultural instruction, surely, *self-interest* will be a sufficient reason. It is not too much to say that, if sound agricultural knowledge was diffused over the country, *famines would be less frequent and less severe in their character*; that there would be less need for the frequent large annual remissions of rent; that the vast capital sunk in railways, canals, irrigation works, &c., would bring in more remunerative returns, while we would not have large areas of land abandoned as has recently been witnessed in different parts of India, because the irrigation means provided by the Engineer are *too complete* for an easy-going agriculture.

"I have no desire to advocate the merits of the educational scheme at the expense of the merits of the farm scheme; there is nothing of an opposing character in the two schemes. It seems to me that, in the true order of development, the farm scheme would naturally arise out of the educational scheme. I am very strongly of the opinion that, in the present state of our rural affairs, an institution, such as the Board desire to see established, will produce results of far greater importance than those that could possibly arise from the working of District Farms, with such inefficient means as we can now only command, while, in the first outlay and in the annual working charges, such an institution would be much less costly, than the farms it was proposed to commence at once, in four districts of this Presidency. Even, if we could command the means to admit of these farms being worked in a really efficient way, I do not think that they would be of great use as mere example farms, in the present state of education amongst our rural population. The fact is, example farms belong to a higher stage in agricultural improvement than has yet been reached in this country. Example farming will undoubtedly now do some good,

but the benefits that will result therefrom will be obtained at a very considerable expenditure of time, labor, and money, in comparison with what would be effected by such farms, established a few years hence, after direct agricultural training had, for some time, been in operation.

"A District Model or Example Farm is the exemplification of the sum total of all local experience. On such a farm we say that this practice is the practice that is best suited to the particular soil of this district, that this or that kind of manure applied in this or that way will yield the best results on the soils of this district; that in this district this or that crop yields the largest returns when cultivated in this or that way, and that this variety of sheep or that variety of cattle is the most suited to the district. Now it is evident that such farms cannot be started at present. We have, in most districts, *yet to ascertain* the facts, which it is the special duty of an Example Farm to diffuse. Such farms in this country, where so little is known of the first principles of agriculture, and in which the practice is purely empirical, must be preceded by Experimental Farms, whose duty it will be to collect and verify the information upon which the practice, on the Example or Model Farm, is to be based.

"But, before Experimental Farms or Stations can be started, we must be able to command the services of well educated, trained men, not men whose agricultural knowledge is confined to the details of mere routine work of ordinary, or improved farming, important as such knowledge is, but men who are capable of making observations, men who can think for themselves and who have a sufficient acquaintance with the natural sciences, to be able to form accurate deductions on what they do observe, and form reliable conclusions on the results of the experiments they may conduct. The information yielded by an agricultural experiment, when carefully observed and intelligently interpreted, may be of the utmost value; so, in a corresponding degree will be the injury, if our cultivators should be induced to change their practice from the supposed teachings of an experiment which had been improperly or ignorantly conducted; indeed, it would be better to allow our ryots to pursue their present imperfect practice, rather than that they should be induced to adopt other and unfamiliar methods, on the faith of the accuracy of deductions founded on improperly-conducted experiments. In this country much injury has already been done, and serious difficulties have been thrown in the way of effecting improvements in our agriculture, from causes such as these.

"If, then, I am correct in thinking that we must secure the services of well-trained, really competent agriculturists before we can start our district farms, the next question that presents itself is, can such men be procured in this country, or elsewhere, on reasonable terms? This I experience no difficulty whatever in at once answering in the negative. Such men as we need are not now procurable in this country, nor are they obtainable anywhere, except (and then without Indian experience) at a cost far above what we would be justified in incurring. But in this Presidency a large number of young men are annually leaving our Schools and Colleges, many of whom possess a slight acquaintance with Indian rural affairs. To these young men something is due in our having disturbed the easy-going arrangements under which their fathers lived. Many have been drawn from agriculture, and some would doubtless gladly return to an agricultural career, could they but see a way in which this could be done, without sacrificing those prospects and hopes that have sprung up with their progressing education. There is thus an abundance of raw material, ready at hand, out of which, under a good system of agricultural instruction, we might hope to obtain the men needed for our proposed farms.

"I attach great importance to the fact that the proposed institution is to be established, not merely to supply superintendents and other officers for our district farms, but also to afford an agricultural education to *all* approved students. It would have been extremely unfortunate had the scheme been narrowed down to provide only the agency needed for carrying on the proposed farms, though, of course, for some time, the main efforts of the College must be directed to qualifying, as speedily as possible, a number of young men to meet the *immediate* requirements of Government.

"In organising the institution, we must not lose sight of the fact that our Presidency contains something like thirty-one millions of persons, and that of these fully two-thirds are engaged directly or indirectly in agricultural employments; that nearly the whole of these people occupy the same low level in the scale of civilization; and that, in the absence amongst them of resident land-owners, with education and sufficient enterprise to lead in any attempt to improve their husbandry, they can but look to Government for advice and guidance. There cannot, I think, be any doubt but that Government action in this direction will result in a direct increase in the land revenue considerably in excess of the amount which this action may cost, while the indirect results in stimulating and developing private enterprise will relieve Government of much of the anxiety which, during seasons of scarcity, they must experience concerning the welfare of cultivators on private estates, as well as of those cultivators more immediately connected with them, while the expenditure usually incurred during such emergencies will be proportionately reduced.

"To give full effect to the Board's proposals, and to confer on agricultural education, something of the status that has been given to medical and engineering education in this Presidency, by the erection of Colleges supported by Government, devoted to these special objects, it is necessary that an Agricultural College should be erected. Such a building has been found to be absolutely required wherever any attempt has been made, in a moderately extensive way, to provide agricultural instruction. It is no more possible to afford a systematic professional education in agriculture without lecture-rooms, class-rooms, a reading-room, a museum, a library, &c., than it is, without these aids, to afford a professional education in medicine, &c. I do not ask for elaborate and costly structures, but at present only for such a building as will provide the accommodation needed.

"But not only do we need a building in which we may find the accommodation we require, but that building should be situated in the midst of the scene of our practical instruction. This is *very important*. It will be difficult with Hindu students to combine our practical and theoretical teaching under any circumstances; but these difficulties would be greatly increased if the building in which the theoretical teaching is conducted is situated away from the farms.

"The general arrangements of the College, as regards management and admission, should, I think, be something similar to those of the Medical and Engineering Colleges.

"The instruction to be given in the institution will, for a time, be rather that of the school than that of the College. We must, at any rate for two or three years, conduct a preparatory class to enable our students to benefit by the lectures that they will afterwards attend when they get into the College classes. But, as soon as there are men who have passed satisfactorily through the whole course available for elementary work in the districts, the preparatory class at the College should be abolished, when the energies of the teaching staff might be devoted to work of a more legitimate kind. To bring about this desired result, in a more speedy way, it might be well to invite young men who are studying for school-teachers to attend a short course of instruction to qualify them to conduct a small preparatory class in the schools with which they may afterwards be connected, the inducement to be offered being a small fee for each student they succeed in qualifying for admission into the College.

"The course of instruction at the College should, I think, at present extend over a period of three years, one year in the preparatory class and two years in the College classes; this to be afterwards reduced to two years in the College classes only, when the district elementary classes have been established.

"To afford a practical as well as a theoretical education, arrangements should be made to admit of each student becoming thoroughly acquainted with agricultural operations on the farm itself. Each student should, during a considerable proportion of his pupilage, be engaged in the actual work of the farm, not that his labor will be of any use to the farm, but because he can become a farmer in no other way. Such employment should be purely for educational purposes, and as such can be of use only to the student himself. It may pay the farm to employ young men constantly at the work with which they are best acquainted, but from such employments they would learn but little. For educational purposes they must be engaged in occupations of which they know little, and such employments, however beneficial from an educational point of view, are never remunerative in rupees. But, not only must our students engage in farm-work as a part of their direct training, but because a taste for agricultural pursuits can be fostered only in this way. Agricultural students who have pursued a College course without undergoing any practical training seldom engage in actual farming, as they are removed from all sympathy with farmers at the time of life when tastes and habits are formed; while an occasional employment in the lighter work of the farm will conduce greatly to healthy bodies and sound minds; it is necessary that we should develop the physical as well as the mental powers of our students. In framing the curriculum of study there will, I think, be no difficulty in providing facilities to enable each student to make himself thoroughly acquainted with practical farming.

"In the preparatory class the instruction to be given should be such as will enable the young men to qualify themselves for admission into the College classes. When in the class-room this class should, I think, be under the charge of a literary teacher, who could give instruction in Farm Book-keeping and also instruction in Mensuration sufficient to enable the members of the class to measure and value any kind of agricultural task-work, to ascertain the cubical contents of a heap of manure, a stack of hay or of corn, the weight of cattle, &c., and with the chain to measure small areas of land, &c. He should give instruction in the use of maps and plans, and should make his pupils acquainted with the ordinary meteorological instruments, their uses, &c. This class should read together the different elementary text-books on the subjects of the lectures, which they will afterwards attend; and during the reading of these books, the teacher should avail himself of every opportunity to make the young men understand the meaning of the different scientific and technical words with which they may meet. Monthly

examinations should be held, in order that the progress made by the members of this class may be ascertained.

"The lectures to be delivered during the College course of two years should, I think, be on Agriculture, Agricultural Chemistry, Vegetable Physiology, and Agricultural Botany, Animal Physiology, and the pathology and treatment of the diseases of the animals of the farm, Practical Geology, &c. In addition to lectures there should be conversation classes on the subjects of the lectures, occasional field classes, and a select laboratory class. * * * * * Europeans, East Indians, and Natives should alike be eligible for admission into the institution. No fee of any sort should be charged until the institution has been some time in existence, but every student should be compelled to provide for himself the text-books, &c., required in his class.

"It appears to me that there should be three divisions in which to class those who wish to undergo instruction in the institution—a division (1) for those whose stipends will be paid by Government; another (2) for private students and students who will be supported by the nobility and wealthy land-owners of the Presidency; and a third (3) for those persons who enter for attendance at lectures only. * * * * * The comparatively small sum, that will be needed to provide the means necessary, to give effect to the foregoing proposals, will represent but a very insignificant amount when contrasted with the importance of the results that may spring from the education to be given. In the Irish Agricultural Institution in Dublin *nearly the whole of the students are boarded and educated at the entire expense of Government.* The same is done in nearly all the countries of Europe in which small farms prevail, while in the United States every State Agricultural College provides board and education for a number of youths—sometimes as many as one hundred—entirely at the expense of the State, and if such is necessary in these countries, surely we need to do as much in this Presidency."

7. The Board in submitting to Government this letter seemed (one member however dissenting) to have changed their views to a considerable extent, and they now advocated the postponement of the educational scheme until further information regarding the state of agriculture in the Presidency had been collected.

8. The system under which the apprentices were being trained at Sydapet, continued, therefore, unchanged. In my report for the official year ending 31st of March 1874 I again wrote regarding these apprentices :—

"Though, making due allowance for the circumstances under which they were placed, these apprentices have done fairly satisfactory, they have made but very little progress towards qualifying themselves to hold District Farm Superintendentships; however, they are not to be blamed on this account; it was decidedly a mistake to suppose that Hindu youths, without any knowledge whatever of agriculture or of kindred subjects, would, in the space of three years, by mere field employment on the Sydapet Farm, become qualified to hold the Superintendentships of District Farms. Such a training as I have often pointed out, should qualify them to manage small farms of their own, situated in localities similarly circumstanced to the Sydapet Farms, and it should qualify them for employment as Overseers under efficient superintendence; but it could not in reason be expected to do more than this. Under a good system of theoretical and practical training in the lecture-room and the field, there would be no difficulty whatever in training educated native youths thoroughly in agriculture."

9. In G.O., dated the 19th of March 1875, Government reviewed generally the proposals for engaging in agricultural instruction and expressed the opinion that though the scheme I had submitted was beyond present requirements, it was, nevertheless, desirable to make use of the means at hand for the commencement of agricultural education, and they accordingly directed the Board, in communication with me, to submit a detailed scheme under which a definite course of instruction could be afforded.

10. In the Proceedings of the Board, No. 969, dated the 20th of April 1875, I was directed to draw up and submit the detailed scheme called for by Government. I accordingly drew up a scheme and submitted it in the form of a draft prospectus; this, after undergoing some slight modifications, was sanctioned by Government.

11. The following extracts are from this revised prospectus :—

"OBJECTS.

"This institution is designed to afford instruction in the science of agriculture and in the practical application of sound principles in conducting the ordinary agriculture of this country.

"MANAGEMENT, &c.

"This institution will be attached to the Educational Department under the general control of the Director of Public Instruction, acting in communication with the Board of Revenue. The direct management of the institution will be entrusted to the Superintendent of Government Farms, who will conduct all correspondence regarding the institution, will issue all notices, orders, &c., regarding the delivery of lectures and other matters connected with the routine of the institution, and will maintain discipline amongst the students who will, in all things, be subject to the orders he may issue.

"INSTRUCTION, &c.

"The course of instruction will extend over three years; there will be two sessions in each year, a Summer Session and a Winter Session; the Summer Session will begin each year on the 1st of April and will end on the 30th of June; the Winter Session will begin on the 1st of October and will end on the 31st of March. Though in the Winter Session class-room and lecture-room instruction will not begin until the 1st of October, students will nevertheless be expected to attend at Sydapet on the 1st of September, in order that they may witness and take part in the important field operations conducted at that season in connexion with the sowing of the cold-weather crops.

"The instruction given in the institution will embrace a thorough study of agriculture and of such portions of Chemistry, Geology, Zoology, Botany, and the Veterinary Art as bear on the theory and practice of agriculture. In addition to these special subjects, the following will also receive attention:—Farm book-keeping, land-surveying, mensuration, and drawing. The instruction will be given by means of lectures, class-room discussions, and field classes.

"During the portion of the day set apart for practical instruction in farming out of doors, every student will be expected to take part in whatever work is going forward on the farm; compliance with this regulation will be strictly enforced. Each student will be expected to make himself acquainted with all the operations daily performed on the farm, and will be required to keep a journal or diary of the same.

"Instruction will be conveyed in the English language, but the Masters will afford as much assistance as possible in explaining the lectures, and instruction generally, to students whose limited acquaintance with English may make it difficult for them to follow such instruction without explanation.

"ADMISSION.

"Europeans, Eurasians, and Natives of all classes are eligible for admission into the institution when vacancies exist, on complying with the following conditions:—

"Candidates who desire to avail themselves of stipendiary studentships or scholarships must be between sixteen and twenty-four years of age, and must produce with their application for admission the following certificates:—

(*a.*) Certificate of age.
(*b.*) Do. of character.
(*c*) Do. of physical fitness.*

"For the present no fee will be charged except in the case of students who enter only for instruction in special subjects; strict conformity with all the rules of the institution will be enforced.

"Students must provide themselves with all necessary text-books, stationery, &c.

"Students who have passed the Matriculation or General Test Examinations will be eligible for admission without undergoing any further examination, provided they produce the certificates needed, and comply with the other conditions laid down. When there is a greater number of these candidates than there are vacancies to fill, a selection will be made of the most promising, at the discretion of the Superintendent.

When there are more vacancies to fill than there are candidates qualified, as stated in the preceding paragraph, the entrance examination will be as follows:—

English.—Ability to write correctly and legibly from dictation and express themselves with reasonable correctness and intelligence in a letter or in a report.

* Should state that the candidate has been vaccinated.

Arithmetic.—The first four simple and compound rules, vulgar and decimal fractions.

Vernacular.—Tamil or Telugu (in the case of Europeans and Eurasians only); ability to translate into English easy sentences from an elementary vernacular prose work commonly used in schools.

History.—The leading facts of the Histories of India and England.

Geography.—The Outline of Geography generally and the Geography of India in particular."

"STIPENDIARY STUDENTSHIPS.

Of the students who have at the close of the first session been most successful, twenty-four will be selected to fill stipendiary studentships, to be established by Government, to which will be attached a monthly salary of Rupees 12-8-0 in the latter half of the first year, Rupees 15 per mensem in the second year, and Rupees 17-8-0 per mensem in the third year, under the following conditions:—

No stipend will be increased until the prescribed examinations have been satisfactorily passed. The stipend will be liable to be forfeited in part or in whole for continued disobedience to orders or neglect of duty, and no person who holds a stipendiary studentship will continue to hold it if found to be unfit to undergo further training from incapacity or want of interest. No stipend can be held for more than two and-a-half years, and cannot be retained unless the recipient pass for the higher grade within twelve months."

"SCHOLARSHIPS.

Three scholarships, each of the value of Rupees 10 per mensem, and tenable for two years under certain conditions, will be given to the three students who, at the end of the first year of training, secure the largest number of marks, and who, in other respects, have given satisfaction. These scholarships are to be held under the same general conditions as are applicable to stipendiary studentships."

"AGRICULTURAL CERTIFICATE.

At the conclusion of the course of training, each student who is found to possess the necessary knowledge, and whose conduct has been satisfactory, will be entitled to a certificate, certifying to his qualifications as an agriculturist."

"SCHOOL-TEACHERS AND OTHERS.

Arrangements will be made under which young men, who are studying in Madras to qualify themselves as school-teachers, will be permitted to attend one or more courses of lectures and to undergo a partial training in practical agriculture at the institution, with a view to teaching this subject in middle-class and elementary schools that may come under their charge."

"GENERAL.

Land-owners and others may enter students at the institution under the same rules and regulations as Government Stipendiary Students, provided the stipends are paid regularly one month in advance to the Superintendent, Government Farms, by whom these stipends will be disbursed under the rules prescribed.

Persons of any age above sixteen who possess a fair knowledge of English may enter the institution to study any special subject or subjects taught therein. They will be required to pay a fee of Rupees 2 per mensem during the time their names are entered in the register of the institution.

"CURRICULUM OF STUDY.

First Year.

Agriculture—Elementary.
Zoology.
Chemistry—Inorganic.
Veterinary—Animal Physiology and Anatomy.
Botany—Vegetable Physiology.
Drawing—Elementary.
Land-surveying and Mensuration.

Second Year.

Agriculture—Crops and Stock.
Geology—Elementary.
Chemistry—Organic.
Veterinary—Therapeutics and Materia Medica.
Botany—General.
Drawing—Plans.
Land-surveying and Mensuration.

Third Year.

Agriculture.
Geology—Agricultural.
Chemistry—Agricultural.
Veterinary—Pathology.
Botany—Agricultural and Horticultural.
Drawing—Machines, &c.
Mechanics, Farm Book-keeping, &c."

Time Table.

Monday ..	6 to 10 A.M.	Field Class	Land-surveying.
	3 to 4 P.M.	Class Room	Arithmetic.
	4 to 5 do.	Lecture	Agriculture.
	5 to 6 do.	Practical Farm Work.	
Tuesday ..	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Veterinary.
	3 to 4 P.M.	Class Room	Mensuration.
	4 to 5 do.	Lecture	Botany.
	5 to 6 do.	Practical Farm Work.	
Wednesday ..	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Chemistry.
	3 to 4 P.M.	Class Room	Arithmetic.
	4 to 5 do.	Lecture	Zoology.
	5 to 6 do.	Practical Farm Work.	
Thursday ..	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Veterinary.
	3 to 4 P.M.	Class Room	Mensuration.
	4 to 5 do.	Lecture	Agriculture.
	5 to 6 do.	Field Class	Do.
Friday ..	6 to 7-30 A.M.	Practical Farm Work.	
	9 to 10 do.	Lecture	Chemistry.
	3 to 4 P.M.	Class Room	Arithmetic.
	4 to 5 do.	Lecture	Botany.
	5 to 6 do.	Field Class	Do.
Saturday ..	6 to 7-30 A.M.	Practical Farm Work.	
	8 to 9 do.	Weekly Examination.	

12. Under the orders of Government this prospectus was published in the *Fort St. George Gazette* and in the local *Gazettes* of this Presidency, and soon afterwards numerous applications for admission into the institution, began to be received from candidates resident in various parts of this Presidency and in the Presidency of Bombay.

13. At first, it was intended to open the institution in the beginning of October, but various circumstances combined to prevent the carrying out of this intention. Before the middle of September, 43 young men had entered their names as candidates for admission into the College, the whole of these produced the necessary certificates of age, physical fitness, vaccination and character. Of these, 17 were qualified for immediate admission into the institution, having passed the Matriculation and other examinations prescribed. The remainder, 26, entered their names as intending competitors at the entrance examination. The entrance examination was held at Sydapet, and at the head-quarters of 2 or 3 districts, on the 23rd

October; and of the candidates who attended, 12 were selected and admitted into the institution. But, before the institution began its work, a number of the first accepted candidates asked for, and were granted, permission to withdraw their names from the roll of the institution, chiefly on account of the famine rendering it impossible, in the majority of the instances, for the parents of the youths to bear the additional cost of the maintenance of their sons at Sydapet. For the vacancies thus caused there were, however, numerous candidates, and from the best of these who had passed the Matriculation or other examinations prescribed, and who, had produced certificates of physical fitness, &c., I selected a number, sufficient for the accommodation available. These accepted candidates were as follow :—

9 Parsees.
10 Brahmins.
10 Vellalars and other castes.
1 Native Christian.

They belonged to the following places ;—

3 South Canara District.
3 Coimbatore District.
3 Chingleput District.
1 North Arcot District.
7 Madras District.
1 Tanjore District.
1 Trichinopoly District.
9 Districts of the Bombay Presidency.
1 Ceylon.
1 Mysore.

30

14. The ages of these men were ;—

Nine aged from 18 to 20 years.
Nine aged from 20 to 22 years.
Twelve aged from 22 to 23 years.

15. The great difficulty experienced, in starting the institution, was the absence of the necessary house-accommodation. Eventually it was decided to make use of, as a temporary arrangement, the granary building attached to the Sydapet Experimental Farm. This is a two storied building and consists of two rooms on the ground floor and one upper room. This building, though very commodious as a granary, is very inconvenient and unsuitable for the purposes of the Institution; the height of the rooms on the ground floor, is less than 9 feet, and, the class room, which is only 30 × 20 feet, is therefore exceedingly close and hot, when it contains the usual class of 30 adults. The upper room, used as a lecture room, is 60 feet long and 20 feet broad, the height of this room to the wall plates is not more than 6 feet, but the roof is open to the ridge plate, which affords better ventilation than is the case with the rooms on the ground floor; but this room is almost as ill adapted for use as a lecture room as are the ground floor rooms for use as class rooms; when there are, as is frequently the case at the agricultural lectures, as many as 50 adults in the room, it is exceedingly uncomfortable; and, from the narrowness of the room, many of the students are necessarily seated so far back from the lecture platform, they, not only experience great difficulty in seeing distinctly the drawings made during lectures on the black board, but also, occasionally, find it difficult to hear the lecturer fully. It is impossible to keep the room moderately cool in the hot season, for the walls are exposed fully to the sun, and the windows are altogether without verandahs or shades; and, from the room being already dark when the sky is at all clouded, the windows cannot be furnished with shades; and another very serious inconvenience which arises from the absence of window shades, is the impossibility of keeping the rain from drifting across the room when there is even

Unsuitability of house-accommodation.

only a very slight wind during a shower. On such occasions, I have had no alternative but to dismiss the class; for, if the window shutters were closed, the room would be so darkened that no work could be done; glass windows would render the room too hot. Light as the rains were during the past session, I had on several occasions to close the Institution from the impossibility of lectures being delivered in the room while rain was drifting through it. I look upon the absence of proper accommodation, in the shape of lecture rooms and class rooms, as a most serious detriment to the work of the institution. Plans and estimates have been prepared, and approved, for providing the necessary buildings, and the funds required are available, I venture to hope therefore that before the expiration of another year the necessary accommodation will be provided.

Institution had to be closed in wet weather.

The absence of proper house-accommodation a serious detriment to progress.

16. His Highness the Holkar founded two stipendiaryships connected with the institution, each of the value of Rupees 25 per mensem. For these stipendiaryships two young men were selected and sent to the College by the Minister of His Highness the Maharajah. These young men signed an agreement by which they undertook to serve the Government of His Highness the Holkar, as Agricultural Instructors, after the completion of their training in the College. The action of His Highness the Holkar in this matter is very encouraging; it is greatly to be desired that the example should be extensively followed.

Holkar State Stipendiaryships.

17. The accommodation being so limited only two or three students could be admitted to study special subjects.

Students studying special subject.

18. Arrangements were made whereby some of the students of the Normal School in Madras, could attend the Agricultural Lectures; of these students 13 attended. These are Matriculates and First Arts men. They are intended to be teachers in Higher-class, Middle-class, and Normal Schools. Some of them may become masters in schools in which agriculture will be taught. Others may, as Deputy Inspectors, have to examine schools in which agriculture will form a part of the curriculum.

Normal School Students.

19. During nearly the whole of the Session applications for admission into the institution were frequently received. The following statement shows the number of these applicants, and the District, Province, or Presidency to which they belonged:—

Numerous applications for admission.

Applicants from	Madras District	31
Do.	Chingleput District	16
Do.	North Arcot do.	8
Do.	Salem do.	1
Do.	Mysore Province	1
Do.	Tanjore District	30
Do.	Trichinopoly District	2
Do.	Coimbatore do.	9
Do.	Malabar do.	1
Do.	South Canara do.	6
Do.	Madura do.	3
Do.	Tinnevelly do.	1
Do.	Kistna do.	1
Do.	Bombay Presidency	31
Do.	Bengal do.	1
Do.	Punjaub Province	1
Do.	Oudh do.	1
Do.	Ceylon	1
	Total ..	145

20. The next statement shows the caste or nationality of these applicants—

Brahmins	63
Parsees	26
Vellalars	8
Idaiyars	5
Vanniars	12
Chetties	3
Christians	3
Mussulmans	2
Kammalars	2
Kshatriyas	1
Unknown caste	20
Total ..	145

We were quite unable to accommodate more students, and I had, most reluctantly, to refuse to admit many, apparently, very eligible candidates.

21. It is a matter of some interest, and I think a very promising sign, the large proportion of these applicants that were Brahmins. The Brahmins are, in the agricultural districts of this Presidency, the leaders of the people, and are much looked up to by the cultivators for advice in the management of land. It may not be generally known that one-quarter of the entire male Brahmin population consists of cultivators, and about 12 per cent. of land-holders; thus more than one-third of the entire male Brahmin population is actively engaged in pursuits connected with the land. The large number of Parsee candidates was also a very encouraging sign. If these enterprising go-a-head people turn their attention to agriculture, much good may be looked for. In many respects Parsees are particularly well suited to be agriculturists. It is to be hoped that the College may be the means of inducing many of them to devote themselves to agriculture, which sadly needs a little of that energy and enterprise which has been so conspicuously shown by Parsees in commercial and manufacturing enterprises.

22. I would particularly invite attention to the numbers of eligible candidates who from so many parts of India sought admission into the institution. In the earlier part of this report in the second paragraph I drew attention to the difficulties experienced, only as recent as 1871, in inducing eligible persons to offer themselves for a course of training in agriculture, even when the inducements offered were of a most substantial kind. The change that has taken place in the opinions of the educated youth of this country, regarding agriculture as a field of employment, must, I think, be very gratifying to all who desire to see this country prosper.

23. The institution did not begin work until the middle of November. A very efficient staff of lecturers was appointed to instruct the students; the majority of these gentlemen, were already engaged in teaching, in the Madras Medical College. The subjects of instruction were;—

Agriculture—Soils and Manures.
Veterinary—Animal Physiology and Anatomy.
Botany—Elementary.
Chemistry—Inorganic.
Zoology—Mammals and Birds.
Arithmetic—Decimals, Rule of Three, &c.
Mensuration—Principles of Geometry and Mensuration of surfaces.
Surveying—Measurement of small areas with the chain.

On each of these subjects a course of lectures was delivered. The following extracts, are from the reports of the lecturers and others on the work of the past Session:—

W. R. ROBERTSON, M.R.A.C., (AGRICULTURE).

"The class met 44 times; 28 of these meetings were devoted to lectures, 13 to field classes, and 3 to formal examinations.

"The class was composed of 45 members, 13 of whom were students of the Normal School.

"The attendance of the students was very satisfactory. The Normal students unfortunately, owing to their vacation falling during the Session, were able to attend only 2 lectures.

"I was very much gratified with the progress made by the class generally. The conduct of all was good.

"The lectures delivered were generally on soils and manures. At the field classes attention was chiefly directed to the practical illustrations afforded in the fields to the instructions given in the lecture-room. Owing to the prevalence of the drought ordinary agricultural work was not so active as usual, but many valuable lessons were learnt as to the means available to the agriculturist for modifying the ill-effects of such unfavorable seasons."

G. WESTERN, M.R.C.V.S., (VETERINARY).

"The class met 22 times, and the allotted hour was occupied with lectures, anatomical demonstrations, and occasional *viva voce* examinations. The class consisted of 30 students.

"I have found the members of the class throughout the Session attentive and eager to learn, and have been agreeably surprised at the very creditable papers written by the majority at the examinations. I must however, I regret to state, except some four or five from this general commendation.

"I have experienced much difficulty in procuring specimens to illustrate my lectures, and fear that in consequence the matter thereof has not always been so well understood as it might otherwise have been. This might be remedied in future by procuring a good selection of anatomical models and diagrams of the more important parts and organs of animals from Europe. For diagrams I have hitherto had to depend entirely on what I could prepare privately or obtain on loan from the Curator of the Government Central Museum, and I am much indebted to that officer for assistance in this respect.

"The instruction hitherto given has been of the most elementary description, my intention being to give a general outline of the structure and functions of the organs of the animals of the farm, and subsequently to reconsider the various branches of the subject in the order of their importance and interest to the agriculturist."

R. WILKINS, F.R.C.S., (BOTANY).

"At the commencement of the Session there were 16 students in the class; very shortly afterwards the number was increased to 32.

"Lectures on the subject were delivered bi-weekly; the number up to 31st March amounted to 22. They embraced an account of roots, stems, leaves, and flowers, and were illustrated by sketches on the black-board and by fresh and dried specimens.

"One oral and three written examinations were held, for which marks have been assigned. In addition to these, the class was examined for a few minutes at a time, at every meeting, on the subject of the previous lecture.

"All the students conducted themselves well, and I am satisfied with the progress made by most of them; a few have not done well."

W. HAMILTON, (CHEMISTRY).

"The number of meetings has been 29. Three examinations were held, two class and one sessional. In addition the students were examined at each meeting, for 20 minutes, on subjects which were considered in the previous lecture.

"The lectures were, as far as practicable, illustrated by experiments.

"At the commencement of the Session there were 16 men. Fresh admissions were granted from time to time, until the total number on the roll amounted to 32.

"The conduct of the students has been unexceptionable, and their industry good. Many of the men in the class are intelligent, and have evinced a fair degree of aptitude in grasping the [illegible]cts and theories of the subject. A few from defective preliminary training and inadequate [illegible]ledge of English have kept far behind the others. About one-half of the class have made [illegible]progress."

J. KEESS, M.D., &c., (ZOOLOGY).

"The class met 14 times during the course of the Session, and had one oral examination and two written examinations.

"Mammals and birds formed the subject of my lectures. The students exhibited great interest in the subject of zoology.

"The behaviour of the class has been unexceptionable."

A. GANAPATI AIYER, F.A., (ARITHMETIC).

"The class met 24 times; 22 lessons were given and two examinations held. The portions studied were Decimal Fractions and Simple Rule of Three.

"The class consisted of 28 students.

"The conduct of the class was on the whole satisfactory, and the students with a few exceptions acquitted themselves very creditably at the examinations held during the Session."

T. V. SEETHARAM MOODELLY, (MENSURATION AND SURVEYING).

"The class commenced on the 15th January 1877 and met 11 times.

"The subjects taught were: Principles of Geometry and Mensuration of surfaces.

"The Surveying class met seven times. The work done was only surveying with the chain. The conduct of the class during the Session was good."

24. The cottages on the Farm, which had been built for the occupation of the apprentices, have been rented to the students; and, as these cottages were not sufficient, for the number of students who desired to reside on the Farm, arrangements have been made for building several more. The original educational scheme did not provide for the residence of the students on the Farm; but it is certainly, in every way, much more desirable that they should reside there, than in the town of Sydapet.

25. A Reading-room has been fitted up for the use of the students, who have made good use of it. The room is provided with Agricultural News-papers, but, not to the extent that is desirable.

26. A beginning has been made in forming an Agricultural Museum. A fair collection of grains and pulses has been formed. Several skeletons for illustrating the Lectures on Animal Physiology have been received from the Superintendent of the Central Museum, to whom, also, we are indebted for several stuffed fish of the different species found in the Adyar river. Sets of Botanical, Zoological and Mechanical diagrams, as well as some models and two microscopes, have been received from the Secretary of State for India.

27. A Laboratory is urgently needed; without it the instruction in Chemistry cannot be as practical as is desirable.

*28. It is to be regretted that the Normal School students were able to attend so very few lectures; the causes were partly, from the demands of their own institution on their time having on one or two occasions prevented their appearance at the Agricultural Lecture, and partly, from the difference in the Sessions of the two Institutions; the Normal School students having been dispersed very shortly after our Session began, and the new class in the Normal School was formed so late in our Session that I, and the Principal of the Normal School agreed with me, thought that the students could not profit much by attending the Agricultural Lectures, then so near the end of the course, from having missed the preceding lectures. The arrangements for the attendance of the Normal School students at the Agricultural Lectures, will require to be reconsidered. Our Sessions, are convenient as regards the Agricultural seasons here, and it is therefore very undesir-

*During the Summer Session but few lectures were unattended by them.

able to alter them; and it is probably as undesirable to alter the Sessions of the Normal School. If more satisfactory arrangements cannot be made for the agricultural education of the students of the Normal School, it will become a matter for serious consideration, whether it would not be better to impart agricultural information, in a few of the principal schools of the Presidency, by means of men who have gone through the entire course of training at the Agricultural College, either, in addition to the means now proposed, or, in substitution for them. Perhaps, a system could be adopted, something similar to that of the Science and Art Department at Kensington in conducting technical and scientific education in different parts of England.

29. The following statement, shows the marks obtained by each student (Normal School students excepted) at the examinations, and, for attendance, during the Session :—

Statement showing the Marks obtained by the Students during the Winter Session ending the 31*st of March* 1877.

Rank Numbers.	Name and Register Number.	Weekly Examinations.													Sessional Examinations.					Total.	Attendance Marks.	Grand Total.
		Agriculture, 27th January 1877.	Veterinary, 3rd February.	Chemistry, 10th February.	Arithmetic, 12th February.	Botany, 17th February.	Mensuration, 22nd February.	Zoology, 24th February.	Agriculture, 3rd March.	Arithmetic, 5th March.	Veterinary, 10th March.	Chemistry, 17th March.	Botany, 24th Mar.	Mensuration, 4th April.	Agriculture, 26th March.	Veterinary, 27th March.	Chemistry, 28th March.	Botany, 29th Mar.	Zoology, 4th April.			
1	10. G. Krishna Prabhu	68	81	85	100	95	65	90	94	85	90	74	77	88	275	178	172	195	185	2,097	112	2,209
2	5. N. H. Patuck	56	82	94	74	79	87	75	94	82	91	95	74	81	265	169	200	170	125	1,993	118	2,111
3	26. C. K. Subba Row	74	84	88	73	90	85	65	75	99	83	88	71	88	273	138	151	178	135	1,938	120	2,058
4	14. V. S. Gurunatha Pillay	83	45	84	90	54	85	75	84	98	58	57	60	81	280	115	126	161	140	1,776	114	1,890
5	11. M. Narayana Row	69	66	82	49	89	74	70	86	52	86	55	70	77	246	155	115	150	105	1,696	116	1,812
6	2. P. D. Moody	85	78	65	50	61	66	70	90	36	70	75	77	48	247	92	94	180	155	1,639	113	1,752
7	17. B. Ramiah Reddy	46	68	62	55	72	93	38	81	66	79	39	63	80	248	125	104	180	100	1,599	116	1,715
8	7. C. Annamalay Moodelly	80	76	63	64	74	58	90	72	52	56	42	50	35	271	87	82	166	165	1,583	112	1,695
9	4. J. M. Chichgar	61	77	68	28	76	61	70	92	36	81	59	37	18	259	136	135	165	115	1,574	120	1,694
10	25. K. M. Nagojee Row	51	59	69	64	71	76	18	77	84	82	37	65	53	237	136	92	135	156	1,561	122	1,683
11	27. E. B. Krishna Row	60	44	57	75	54	68	68	67	99	57	44	54	49	248	90	94	121	115	1,464	114	1,578
12	16. V. Streenivasa Iyer	69	61	59	50	71	80	40	73	85	60	62	69	59	197	86	84	140	100	1,445	91	1,536
13	15. N. M. Rego	72	37	52	20	61	56	60	77	68	54	61	32	77	265	82	108	129	95	1,406	119	1,525
14	1. T. Balasundracharry	78	51	49	30	57	62	80	71	85	51	43	38	46	213	74	108	164	105	1,405	108	1,513
15	28. A. D. Colah	66	58	61	10	77	56	60	74	10	47	53	62	26	250	116	87	156	120	1,389	118	1,507
16	30. B. H. Kotwal	57	54	82	40	64	74	70	65	22	80	56	38	5	210	91	112	112	145	1,377	115	1,492
17	8. F. N. Kambatta	52	34	48	45	60	64	30	63	47	53	42	41	53	205	88	121	131	90	1,267	120	1,387
18	19. M. Damodara Moodelly	58	40	55	25	61	79	75	72	31	58	45	50	49	210	49	62	128	105	1,252	119	1,371
19	9. A. Mooroogasa Pillay	68	38	55	74	59	67	60	56	69	28	17	17	50	168	35	48	146	120	1,175	120	1,295
20	3. T. Varathiah	73	28	31	..	50	66	40	71	50	55	28	39	44	224	58	57	123	90	1,127	120	1,247
21	29. B. M. Dadiana	38	35	69	10	41	55	50	56	17	48	55	51	23	226	52	85	76	70	1,057	120	1,177
22	20. R. Thamodara Naidu	..	..	44	29	59	57	40	47	25	37	34	51	51	230	56	76	153	95	1,075	58	1,133
23	22. M. N. Swernalinga Naicker	58	41	17	30	48	56	55	38	22	42	11	37	22	199	34	30	114	85	939	108	1,047
24	21. P. Jagannada Moodelly	71	25	45	5	49	46	50	43	20	35	20	37	10	210	46	31	122	55	920	119	1,039
25	6. J. F. Lally	51	43	15	20	43	40	20	41	10	39	19	10	10	142	34	42	99	55	733	108	841
26	23. C. S. Streenivasa Row	36	7	8	5	22	43	10	28	10	8	9	20	23	167	56	42	56	95	645	93	738
27	18. C. Cuppusawmy Auchary	69	31	..	..	..	..	..	..	..	..	..	16	65	143	22	35	108	50	539	30	509
	Full Marks ..	100	100	100	100	100	100	100	100	100	100	100	100	100	300	200	200	200	200	2,400	122	2,522

30. In the Appendix will be found copies of the examination question-papers of the Session, these will afford a very fair idea of the character of the instruction given in the College.

31. The prizes for Note books, were awarded as below :—

Agriculture	..	1st, N. H. Patuck. 2nd, V. S. Gurunatha Pillay. 3rd, A. D. Colah. B. H. Kotwal.
Botany	.. ..	1st, B. H. Kotwal. 2nd, A. D. Colah. 3rd, V. S. Gurunatha Pillay.
Veterinary	.. ..	1st, A. D. Colah. 2nd, M. Narayana Row. 3rd, N. H. Patuck.
Chemistry	.. ..	1st, P. D. Moody. 2nd, B. H. Kotwal. 3rd, V. S. Gurunatha Pillay.
Zoology	.. ..	1st, B. H. Kotwal. 2nd, V. S. Gurunatha Pillay. 3rd, A. D. Colah. N. M. Rego. N. H. Patuck.

32. The expenses incurred, on account of the institution, are shown in the next statement :—

—	August.	September.	October.	November.	December.	January 1877.	February.	March.	Total.	Grand Total.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Agricultural Lecturer ..	....	....	....	....	....	....	....	....	....	
Veterinary do. ..	....	....	....	....	20 0 0	120 0 0	140 0 0	160 0 0	440 0 0	
Chemical do. ..	....	....	....	....	20 0 0	140 0 0	140 0 0	160 0 0	460 0 0	
Botanical do. ..	....	....	....	....	20 0 0	140 0 0	140 0 0	140 0 0	440 0 0	
Zoological do. ..	....	....	....	....	20 0 0	80 0 0	100 0 0	80 0 0	280 0 0	
										1,620 0 0
First Master	....	....	....	150 0 0	150 0 0	150 0 0	150 0 0	150 0 0	750 0 0	
Second Master	....	....	....	....	....	....	54 13 5	100 0 0	154 13 5	
Clerk	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	200 0 0	
Draftsman	....	....	....	4 15 2	20 13 4	24 3 1	24 0 0	23 3 5	97 3 0	
Muchee	....	....	....	....	4 0 0	6 11 10	10 2 1	9 8 0	30 5 11	
Peons and other servants.	....	....	....	....	13 11 3	23 0 0	27 4 2	26 0 0	89 15 5	
										1,322 5 9
Special Charges.										
Furniture	177 12 4	775 11 5	113 8 5	214 5 7	14 12 9	35 10 0	119 10 0	41 4 6	1,492 11 0	
Accommodation ..	....	271 0 8	87 10 11	38 4 7	134 13 0	209 8 7	16 2 0	12 6 6	769 14 3	
Contingencies	62 4 6	....	51 12 9	108 0 11	26 0 6	67 14 11	29 12 7	44 0 0	389 14 2	
										2,652 7 5
									Total ..	5,594 13 2

29*th September* 1877.

WILLIAM ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

THE CAROLINA PADDY EXPERIMENTS

IN THE

MADRAS PRESIDENCY.

INTRODUCTORY.

DURING the past 7 or 8 years a considerable number of reports have been submitted to the Board of Revenue, on experiments with Carolina paddy; some of which contain much useful information. It was thought that if this information could be collected, it would be of use to persons desirous of engaging in Carolina paddy culture in this Presidency. Accordingly, the reports were placed in my hands, in view to the utilization, in a general report, of whatever useful matter they might be found to contain.

2. I have done what I could in the desired direction, but the result is altogether disappointing, from the absence in so many of the reports of the necessary details. I first attempted to classify the results of the experiments, with reference to the climatical conditions under which each was obtained, but I found it impossible, except in a very few instances, to procure the necessary meteorological data, and this course I had to abandon. I next endeavoured to classify the experiments, according to the description of soil on which each was conducted but, from so many of the reports being silent as regards the soil used, this course also, I found impracticable. Next, I attempted to work up and arrange the results according to the peculiarities of culture adopted in each instance, but this likewise, I had to give up from the frequent absence of the required information.

3. Unfortunately, a very large proportion of the reports are valueless from being but the records of failures, from such causes as "floods," "trespassing cattle," "the depredations of birds, insects, &c.," "the failure of water-supply &c., &c." Nevertheless, a considerable amount of useful matter has been collected which, I trust, will be of use to those interested in paddy culture in this Presidency.

4. The numerous extracts I have taken from the reports, have been arranged, generally, as they bear on the crop during growth from seed time until harvest time. A Manual, or Guide, would probably have been more useful than this compilation, but it was desirable to give as far as possible the experiences and opinions of Experimenters located in different parts of the Presidency; and, such a Manual, or Guide to the cultivation of Carolina paddy, prepared with our present limited knowledge, could have been applicable only to the conditions met with in a small area of country.

5. I have endeavoured to show, generally, what has been effected in Carolina paddy culture, under moderately good agricultural conditions, and, generally, the means, by which such results were obtained. Had it been possible to give the exact conditions, history and results in full detail, of a few experiments made in each of the different Collectorates, the information afforded, would have been much more valuable than that now submitted. Though, in recording the history of their experiments, some Reporters have entered fully into details as regards some points of interest, they have, in many instances, overlooked others of equal value, without which the details given are of much less value than otherwise they would have been. I am conscious

that, the connection between the different yields obtained, and the different modifications in the cultivation practices followed, cannot be traced in this report; but, the material available would admit of no other treatment than that I have adopted.

6. The deficiencies of this report however, as a guide to the cultivation of Carolina paddy, are fully compensated for, by the ample, and exact information afforded, regarding the culture of the plant in its home, in America, which I have placed at the end of this report; the more nearly the methods of culture adopted in Madras, approximate to the methods of culture adopted in America, the more likely will successful results be secured. That the climate of Madras, generally, is suited for the Carolina paddy plant has been amply proved. It remains for the Indian cultivator, by adopting an intelligent practice, to secure to the plant those good agricultural conditions which, in America, it invariably meets with.

Large importation of seed from America.

7. In 1869, a large quantity of Carolina paddy of the "gold seed" variety was purchased in America for shipment to India. Of this lot 150 barrels were forwarded to Madras. The Madras supply reached its destination early in 1870; it consisted of 300 bushels; the whole of the grain was perfectly fresh, and contained 92 per cent. of vital seed. In 1872 a further supply, a few barrels, of fresh seed was imported. The quality of the grain was quite equal to that of the supply received in 1870. In 1873, another small supply of fresh seed was received; this grain was also in good order, but it contained only 87 per cent. of vital seed and it was mixed with about 3 per cent. of the grain of an inferior paddy, known to American Planters as "Volunteer" paddy.

The whole of the seed good.

In all, since 1870, about 400 bushels of Carolina paddy seed have been introduced into this Presidency, and with the exception of the drawbacks noticed, regarding the supply of 1873, the whole was of first-rate quality. The seed was, in most instances, supplied to Experimenters gratis, and delivered free of charge. It was

Seed widely distributed over the Presidency.

widely distributed in all parts of the Presidency where paddy is cultivated.

The Soils, and their preparation for the Crop.

8. The soils were ordinary paddy soils under irrigation from river-channels, or tanks; generally situated at low levels, and of alluvial origin. The land frequently was terraced, which arrangement admits of the thorough removal of the irrigation water when done with. Much of the land was however so

No means provided for escape of stagnant water.

situated that it could not be drained excepting by artificial means, and, the Ryot has not yet recognized the importance of getting rid of the irrigation water after it has fulfilled its purpose, by such means.

9. In preparing the soil, the ordinary native methods were usually adopted; these, varied considerably in different parts of the Presidency. In some localities the land was ploughed 7 or 8 times when intended to receive seedling paddy plants. During this preparation, the soil was generally kept covered with water to a depth of 3 or 4 inches; in this way the surface soil was worked by the ploughs into a

Soil worked into mud.

semi-liquid mud, while the layer of soil, immediately below, was puddled and hardened by the feet of the cattle. In some instances, while undergoing preparation, this continued over several days, the soil was manured with the green plant of the Mudder (*Calotropis gigantea*), wild indigo, &c., and with the leaves of different descriptions of trees, at the rate of from 400 to 1,000 lbs. per

Manure.

acre; but, most of the land was unmanured excepting by the silt deposited on it by the irrigation water.

10. Usually, the soil was prepared for seed in much the same way, as when intended to receive seedlings. In either case, the surface was worked into a puddle, the process being more thoroughly performed when it was intended to plant seedlings. The following extracts, from the reports, show how this puddling process was carried out:—

"After standing thus for two days until thoroughly saturated, water was again let on the field to the depth of 2 inches. On the following day the land was again

ploughed thrice and the mire left to stagnate for two days after which it was manured with street sweepings, cattle litter, &c. On the following day the field was again ploughed three times and watered to the depth of one inch, the surface of the mire being smoothed by means of a plank drawn by bullocks; after this the soil was manured with leaves and green plant which were trodden into the puddled soil."

"The plots were puddled and worked according to the usual Native system. The manure was put into the puddle and worked thoroughly amongst it by means of the plough. The seedlings were not planted out until the first effects of the rapid putrefaction of the manure had passed off. * * * Before planting commenced the soil was again thoroughly puddled. The plants were put down in bunches of two or three, placed about eight or nine inches apart; they were usually pressed into the puddle by the hands of the coolies; very little pressure was required; the puddle was so soft, eight coolies planted an acre per day."

"The ground was turned up with the ordinary small plough of the country in August, one month before the seed was put down. Again five days before sowing it received two ploughings on the same day; again two days before sowing it received two ploughings; and lastly the manure, leaves, and dung were put down; the ground was again ploughed twice over, after which the seed was sown. At the time of sowing the land was under water and in a puddle."

"The grounds were ploughed up six times with the country plough. The slices of soil were well broken and the ground was then levelled. Jungle leaves were mixed through the surface of the soil, and it was left alone in that state for a period of 35 days, so that the necessary putrefaction of the leaves might take place. By that time the puddle became sufficiently putrefied and produced a noxious smell. The land was again ploughed up twice by means of the country plough."
This latter description refers to the preparation of the soil for seed.

11. In some instances, the soil was prepared without undergoing puddling. The following extract, describes this practice:—

"In this kind of sowing the Ryots generally keep the land ready well ploughed and manured and await a moderate shower of rain to commence the sowing. As soon as they get rain and the ground is sufficiently saturated the seed is sown in lines by means of a bamboo seed-drill. If the rain is heavy, they wait for two or three days till the ground is sufficiently drained. If the weather is showery, no irrigation water is applied during the first three or four weeks, and the grass which springs up in the interval is removed by frequent weedings."

12. There can be no doubt but that the puddling of the soil as described in some of the foregoing extracts, is highly objectionable. The physical character of the soil is very injuriously affected as, from the semi-liquid state into which the soil is worked, the heavier particles sink below, hence the surface soil, which is formed of the finer matter, is close and compact, a condition highly favorable to the retention of water on its surface, if this, was a result desirable to secure, but, as the good effect of irrigation water, depends upon the water *passing into and through the soil*, the condition referred to, is very objectionable. It is true that, when land has once been puddled, it is difficult, at first, to work it, in a satisfactory manner, in any other way, but, if in each year the puddling process is less fully carried out, the soil will gradually be restored to its normal condition. The puddling of the soil is done in order to make the water, apparently, go further, but, where sufficient water cannot be commanded for paddy, without thus injuring the physical state of the soil, it would be better, in every respect, to crop the soil with some other crop. Some fairly good results have been obtained in Carolina paddy culture where the soil was puddled but it is evident that, in such instances, the land was either situated at a moderately high level, which admitted of good surface drainage, or, it rested on a moderately porous sub-soil. In some instances, where the land was thoroughly worked in a dry state, before irrigation commenced, the results, apparently, were not better, than when the puddling process was adopted, but, there may have been causes to account for this, of which the reports have taken no cognizance.

The puddling of the soil objectionable.

The irrigation water should pass through the soil.

Puddling obstructs the passage of the irrigation water down through the soil.

13. The Carolina paddy plots, in many instances, received better treatment, as regards manuring, than is usual in the treatment of land for ordinary paddy. This, probably, was because many of the plots were located near the head-quarters of a District, and away from the larger irrigation rivers, the waters of which, usually, bring down so much silt that manure is not considered to be needed on the land they irrigate. Owing to the swamping of the land, during irrigation, it is usual, when manure is applied, which is quite the exception, to apply some substance which by gradual decay affords plant food. If a quickly acting manure was used, the probability would be that it would all be dissolved in, or carried away by, the first irrigation flood the land received.

The experimental plots were not usually irrigated by water of the larger rivers.

The seed, seedlings, and the method of sowing and planting.

14. As before noticed, the seed was sometimes sown directly in the land, and, at other times, it was sown in nursery beds, in view to raise seedlings for transplanting. When sown broadcast on the puddled soil, the seed was usually in a sprouted state; the process followed in sprouting it is described in the following extract:—

"The seed, which is to be sown, is put in pots at sun-rise and water poured in them to the brim. The pots remain in that state till evening, when some straw is placed in the mouths of each and they are turned upside down. They remain in that state all night, during which time the water drains away. The next morning water is poured in the pots, but is immediately run off, and the pots are inverted again as on the previous evening. In this state they remain all day. The seed is then placed on baskets and wet straw is spread over each and kept on by weights. The following morning the seed begins to germinate when it is taken to the field for sowing."

15. The practice of transplanting paddy is not common throughout the Presidency. It appears to prevail more generally in those portions where the water-supply is good and labor abundant. Even where the practice is common, it is far from usual to raise the seedlings in nursery beds; frequently the Ryot sows one or two of his fields thickly, in view to the plants to be thinned out being used for planting other ground, and perhaps it is to this practice we must attribute some of the failures in the experiments with transplanted Carolina paddy seedlings. It has been shown, again and again, that, while the roots of the indigenous paddy are confined chiefly to the surface soil, those of the Carolina paddy go deep down into the soil when they meet with favorable conditions. The following extract from a report by the Superintendent of Government Farms dated 1872 shows this:—

"These roots are average specimens; they were collected off some land we ploughed on Saturday, from which crops of Carolina and country paddy had just been removed. The land is all of one description and quality and the crops were cultivated in an exactly similar way. The roots illustrate in a very forcible way the different habits of the two varieties of paddy; the Carolina *feeds deep down in the soil*, while the country variety is a *surface feeder*. It is evident therefore that land with a healthy surface, only about 3 inches in depth, can *never* produce a *good* crop of Carolina paddy, though it may produce fair crops of the country variety. In such soils the Carolina grows well enough until its roots begin to pass down into the unhealthy under-soil, when it sickens, turns yellow, and dies; while the country paddy, whose roots never reach this unhealthy under-surface, may thrive and yield fair results."

Many Experimenters, noticed the difficulty of taking up, uninjured, the seedling plants thus;—

"Much difficulty was experienced in pulling up the Carolina paddy plants for transplanting, the roots having struck so deep down (10 to 12 inches) into the soil."

"Difficulty was experienced in pulling up the plants for transplanting the process on a given quantity of land occupied twice the time within which the country paddy seedlings could be raised from the ground."

16. An opinion appeared to be generally held that the Carolina plant cannot bear such ill-usage as that to which the country plant is usually exposed when being transplanted. But, the difference in the root growth of the two varieties of paddy, fully explains the matter. The evidence afforded in these reports is conclusive as to *the necessity of employing properly prepared nursery beds for raising Carolina paddy seedlings for transplanting*. Seedling plants of all ages from 20 to 50 days were used in the experiments. The general experience was, that seedlings aged from 20 to 28 days were the most suitable for transplanting. By the use of older seedlings there was, of course, some saving in the fewer number of days the crop required to be watered in the field, but this advantage was negatived, in most instances, by the more serious check these older seedlings received to their growth on being transplanted.

Transplanted seedlings injured from rough treatment.

Irrigation, and, Culture of the Crop.

17. The irrigation water was, in most cases, derived from river-channels and tanks. The former of these convey to the fields river-water which has been obstructed in its downward passage to the sea by dams or anicuts. These dams or anicuts are usually placed across the river-beds in situations where there is plenty of room for storing water, and where, from the height to which the stored water can be raised, it will flow by gravitation through a channel to the land. The water of these irrigation rivers contains silt, at certain seasons a considerable quantity. The tanks, are natural or artificial reservoirs; they are usually filled by the surface drainage of the adjacent country after heavy rains; in some instances they are supplied with water from a neighbouring river, but such cases are rare. Generally the tanks are situated on sloping land so that, while they secure the surface drainage from the higher country, their water will yet flow by gravitation upon neighbouring land at lower levels.

River-channels.

Tanks.

18. The irrigation practice of the Carolina paddy Experimenters, differed but little from that usually followed in the treatment of country paddy in the portions of country where the experiments were conducted; thus;—

Irrigation practice.

"The field was not again watered until the evening of the 12th July or 5 days after it had been sown, when water to a depth of one inch was let on. From this day forth the young crop was watered twice a day, except when it rained. By the 10th of October, or just about 3 months after the seed was sown, the crop had attained its growth and came into full ear. From the 27th of October the field was only watered every alternate day to the depth of an inch; from the 6th of November no further irrigation was required as the crop was near maturity."

"The land was irrigated on each day of ploughing, that is, on four days inclusive of the day of sowing. The water was not again let on until the plants appeared above the surface which was on the third day. From that time until the crop was ripe, water was daily supplied to a uniform depth of 2 to 3 inches, but it is impossible to speak with more precision than this, because the supply over the whole field would not be uniform, that portion adjoining the channel receiving more water than that more remote."

"Water was applied daily at the rate of 2 to 3 inches in depth."

"The crop was watered every alternate day for a week after that until the harvest; there was always 1 inch of water on the land."

The next extract refers to a successful experiment made on the Sydapet Farm with a *minimum* quantity of water, on land which had not previously been under paddy:—

"During the growth of this crop the ground was watered 22 times, each time with a quantity equal to a rainfall of 1½ inches; the rainfall during 93 days from planting to reaping amounted to 14·81 inches, making the total quantity of water used nearly 48 inches, but fully one-third of the rainfall was lost, from it having fallen when not required."

Several of the Experimenters report that, from their, experience, the Carolina paddy seemed to require much less water than the ordinary country paddy. One wrote:—

"After transplanting, water was allowed to reach to one-third the height of the plants, but this was found not to suit as the plants turned unhealthy and of a yellowish color; the water was then withdrawn and allowed in quantity merely sufficient to keep the ground thoroughly moist. The appearance of the crop improved directly the excess of water was removed."

"The crop was cultivated in the usual way, but failed evidently from over-watering."

"I am inclined to attribute the small yield of Carolina paddy * * * to two causes—first, water was distributed in equal proportion to each crop (Carolina and country paddy) and the Carolina when I saw it appeared to have had almost too much water."

On comparing the practices here described with the practice common in America in irrigating paddy land, *vide* the "Notes" at the end of this report, it will be seen what a wide difference there is. In America, during the time the crop is growing, 150 days, the land cropped is under water only for about 68 days; while, there are two intervals each, of more than one month in which, the crop is dealt with as a dry crop. In this country, under ordinary circumstances, a month of dry tillage would prove fatal to a crop of country paddy and probably, to a crop of Carolina paddy also, except under very favorable circumstances.

19. Except an occasional weeding, the experimental crops received little attention during growth. The practice of hoeing appears to be almost unknown. But, in one or two Districts, notably in Nellore, the soil was loosened, between the rows of plants, by means of a light Country plough. The almost entire absence of tillage operations on the land while the Carolina paddy plants were growing is, undoubtedly, one reason why in some experiments the results were unsatisfactory. But, tillage during growth is possible, only on soils on which the plants are growing in lines, and this with paddy, is but rarely the case in this Presidency.

Observations made during the growth of the crop and, at harvest.

20. The Carolina paddy generally came into ear at from 10 to 12 weeks after the date of sowing. From many localities complaints were made that all the ears did not mature at the same time, thus making the harvesting of the crop, in a satisfactory way, a difficulty; however, there are equally as many reports in which it is stated that the plants did not shed their seed nearly as readily as do plants of the indigenous varieties of paddy. Hence, if the harvesting was delayed, in order to allow time for the ripening of the backward ears, there was no loss from the shedding of the seed, and, the drawback experienced in the delay of the harvesting operations, is not felt in any deterioration of the straw, as is usual with country paddy, for the Experimenters generally agree, that the grain is always ripe, long before the straw. It was observed that crops raised from seed, matured ten days earlier than crops raised from transplanted plants, the produce of seed sown at the same time. This result, was attributed to the check in growth the plants usually suffered from on being transplanted. Excepting in the time in reaching maturity there was but little perceptible difference, in the crops produced from seed and from transplanted seedlings, when grown under similar conditions.

Transplanted crops longer in reaching maturity than sown crops.

21. The Carolina paddy plants on many of the experimental plots appear to have been unusually unfortunate in attracting such destructive foes as locusts, hares, &c. From one report the following interesting extract is taken:—

"All at once, and this is the strangest part of my story, the Carolina was attacked by locusts which, while leaving unharmed all the country paddy around, deliberately destroyed the Carolina paddy down to the ground."

It may be that the succulent robust growth of this paddy, which all Experimenters admit, afforded a more juicy stem, and therefore a more attractive food than the culms of the country paddy.

* * *

Ears of Carolina paddy heavy.

22. The ears of the Carolina paddy were reported, in many instances, to be from one-third to one-half heavier than those of country paddy grown under similar conditions. The average number of grains in an ear varied from 150 to 200, while many plants had from 10 to 12 fertile ears. One Reporter wrote:—

"I plucked indiscriminately a quantity of three kinds of paddy that were growing side by side. The following is the average number of grains on a single stalk of each:—Carolina 210 grains, Car paddy 101 grains, Sembalay 94 grains. I also observed that the Carolina grains stick very closely to the ears."

The Collector of Cuddapah, reported as follows:—

"I was present at the time of reaping and was surprised to see that the outturn was double that obtained from an equal extent of similar land cropped with country paddy. The stalks stood erect, were stronger and thicker, and obtained the uncommon height of from 4 to 5 feet."

The Produce.

Difficulty of separating the grain in threshing.

23. Many of the Experimenters, noticed the difficulty that was experienced in separating the grain in threshing. One wrote;—

"When the sheaves were threshed it took 8 or 9 strokes to shake off the grain, whereas for the ordinary country paddy I am informed four strokes suffice."

The reports agree generally, as to the uniform size of the grain and, its freedom from the thin shrivelled grain which, in samples of country paddy forms such a considerable percentage.

24. The threshing was usually performed by striking the sheaves on a log of wood, the way in which country paddy is threshed. The difficulty with which the grain is separated, is not a fault, as some suppose. It is certainly true, that more labor must be expended in threshing Carolina than country paddy, the grain of the latter separates so easily, *too easily for the Ryot's interests*, for, even with the greatest care, a considerable quantity of its grain is always shed in the field during the harvesting operations. Carolina paddy, is not more difficult to thresh than other cereals; it is certainly much more easily threshed than oats or barley.

Quality of the straw.

25. Regarding the quality of the straw opinions varied greatly;—

"The straw was for the most part strong and well grown, thicker, and stouter than the straw of indigenous varieties of paddy, and the Ryots themselves say that it would be more valuable as fodder for cattle."

"On some of the experimental plots the straw was of an extraordinary length."

"The straw is undoubtedly coarser and the cattle do not eat it so freely as the straw of the ordinary country paddy."

On this subject the Collector of Coimbatore wrote;—

"While appreciating the larger yield of grain the Ryots take objection to the quality of the Carolina paddy straw. They said that the cattle would not eat it, and certainly my cattle refused it, but this, I think, was in consequence of its having been rather musty."

It is unlikely that cattle, that so readily eat the hard reedy straw of Cholum and Cumboo, will refuse the straw of Carolina paddy, when it is in a fresh state. When the cattle have refused it, the probability is, that the straw was, as noticed in the preceding extract, musty and unpalatable. Regarding the strength of the straw, the Superintendent of Government Farms, in reviewing some reports on the cultivation of Carolina paddy, wrote;—

The strength of the straw of Carolina Paddy is an advantage.

"The strength of the straw objected to by some Ryots is a valuable characteristic of the Carolina paddy plant; it enables the crop to withstand the effects of rough weather. Storms which would prostrate crops of country paddy pass over crops of Carolina paddy harmlessly."

26. The yield of grain and of straw, from the Carolina paddy experimental plots, varied greatly, as the following statement shows:—

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY.

Number of Experiment.	Taluq or Village	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
			Weight.	Measure.			Grain threshed.		Straw.		Grain threshed.		Straw.
							Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.*			LBS.	MADRAS MEASURES.*	LBS.	FEET.	LBS.	MADRAS MEASURES.*	LBS.
					SOUTH ARCOT DISTRICT.								
	Trickalore Taluq.												
1	Trickalore	22,400	270	..	5th September ..	..	11,564	..	18,540	4½	2,499	..	4,006
2	Do.	5,324	75	..	27th do. ..	21st February ..	1,845	..	..	2½	1,677	..	..
3	Do.	3,338	60	..	27th do. ..	21st do. ..	787	..	1,128	2½	1,142	..	1,636
4	Do.	6,000	73	..	18th October ..	24th do. ..	1,150	..	1,875	2½	928	..	1,512
5	Do.	6,400	62	..	14th September ..	1st do. ..	1,089	..	2,000	2½	824	..	1,512
6	Do.	1,600	26	..	14th do. ..	8th do. ..	220	..	500	2½	665	..	1,512
					CHINGLEPUT DISTRICT.								
	Sydapet Taluq.												
7	Sydapet	980	10	5	22nd September ..	10th January ..	358	168	1,092	4	1,768	830	5,393
8	Do.	1,113	30	..	21st December ..	16th April ..	290	..	804	..	1,261	..	3,496
	Chingleput Taluq.												
9	Nattam..	1,867	..	5	3rd September ..	7th January ..	528	200	..	..	1,368	518	..
10	Do.	1,600	..	6	14th do. ..	20th do. ..	254	96	..	..	768	290	..
11	Melmayur	800	10	4	24th September ..	6th February ..	157	60	..	..	949	..	..
	Madranticum Taluq.												
12	Madranticum	2,667	..	5	19th November ..	28th March ..	491	186	..	..	891	388	..
13	Penayur	2,400	10	4	31st December ..	3rd May ..	315	120	..	..	635	..	..

	Trivellore Taluq.													
14	Nagalapuram ..	720	12	..	1st October ..	..	156	..	337	2½	1,050	..	2,269
15	Palavacum	800	25	..	11th August ..	8th January ..	125	..	..	3	756	..	..
	North Arcot District.													
	Chittoor Taluq.													
16	Chittoor	1,600	17	6	..	19th March ..	690	240	..	..	2,087	..	..
17	Do.	3,200	25	9	..	9th April ..	991	345	..	..	1,499	..	..
18	Do.	800	12	..	7th July ..	12th November ..	246	..	..	..	1,488	..	..
	Vellore Taluq.													
19	Agram	267	..	6	1st September ..	25th February ..	108	..	..	..	1,957	..	..
	Arcot Taluq.													
20	Visharam	1,067	..	8	..	..	356	109	..	..	1,615	..	..
	Madras District.													
21	Madras	2,700	61	..	19th September ..	20th January ..	300	..	710	..	538	..	1,273
	Nellore District.													
	Rapur Taluq.													
22	Rapur	532	17	..	15th October ..	29th February ..	178	..	600	3	1,619	..	5,458
23	Do.	774	17	..	Do. ..	Do. ..	105	..	360	3	657	..	2,251
	Polur Division.													
24	Naidupett	391	10	..	17th September ..	16th January ..	79	..	..	3¼	988	..	..
25	Agraharapett	7,259	127	..	20th do. ..	22nd do. ..	1,223	..	..	3	815	..	..
26	Do.	2,961	42	..	20th do. ..	27th do. ..	260	..	..	3	426	..	..
27	Vinnamala	890	13	..	20th August ..	2nd January ..	75	..	..	3¾	410	..	..

* 104 Cubic Inches, or, ·0468 of an Imperial Bushel.

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
	NELLORE DISTRICT—(*Continued*).												
	Venkatagherry Division.												
28	Menakoor	1,504	34	..	3rd November ..	23rd March ..	281	..	425	..	745	..	1,367
	Kavali Taluq.												
29	Kavali	1,452	11	..	1st September ..	30th December ..	180	..	..	3	600	..	..
	Nellore Taluq.												
30	Nellore	5,857	76	..	11th do. ..	23rd January ..	672	..	1,440	2	555	..	1,189
	KISTNA DISTRICT.												
	Bezwada Taluq.												
31	Velagaleru	284	28	..	1st August ..	26th December ..	150	..	..	3	2,556	..	..
32	Vamavaram	1,306	14	..	9th do. ..	December ..	480	..	..	..	1,779	..	..
33	Do.	1,307	10	..	7th September ..	January ..	360	..	..	..	1,333	..	..
34	Kankipad	2,130	16	..	6th and 7th August	December ..	442	..	..	..	1,004	..	..
35	Do.	2,130	12	..	7th September ..	Do. ..	332	..	..	..	755	..	..
	Nandegama Taluq.												
36	Anumanchepalli ..	387	22	..	July	1st January ..	168	..	..	..	2,101	..	..
37	Do. ..	726	22	..	Do.	Do. ..	168	..	..	..	1,120	..	..
38	Jaggiapett	1,113	18	..	Do.	November ..	354	..	..	..	1,539	..	..
39	Panuguncheprole ..	1,113	57	..	August	December ..	318	..	..	..	1,383	..	..

40	Do. ..	1,210	16	..	Do.	Do. ..	242	..	..	..	970	..	..	
	Bapatla Taluq.													
41	Guntur Peta Mangalageri.	3,560	30	..	1st September ..	30th December ..	1,306	..	3,200	3	1,775	..	4,350	
42	Chebrole	2,400	21	..	20th July	21st November ..	360	..	700	3	726	..	1,411	
43	Do.	2,594	21	..	Do.	Do. ..	277	..	692	3	518	..	1,291	
44	Marripoody	9,680	112	..	..	..	960	..	..	..	480	..	..	
	Repalli Taluq.													
45	Addepalli	532	16	..	12th August ..	28th December ..	150	..	230	2¼	1,365	..	2,093	
46	Battiprolu	1,210	34	..	..	..	180	..	..	..	720	..	..	
47	Chandarole	2,420	50	..	..	..	240	..	..	..	480	..	..	
	Palnad Taluq.													
48	Pinnali	2,420	60	..	..	..	520	..	..	..	1,040	..	..	
	Vallur Zemindary.													
49	Boddapad	3,775	72	..	..	..	480	..	..	..	615	..	..	
	GODAVERY DISTRICT.													
	Rajahmundry Taluq.													
50	Raghudevapuram ..	6,788	40	..	12th July	13th November ..	1,640	..	..	4½	1,169	..	..	
51	China Kondepudy ..	10,264	48	..	3rd do.	15th do. ..	1,640	..	..	4	773	..	..	
52	Stikayalapalli	4,444	40	..	1st do.	2nd December ..	640	..	..	3	697	..	..	
	Tanuku Taluq.													
53	Tanuku..	9,680	50	..	1st do.	20th November ..	1,500	..	..	3¾	750	..	..	
	Yernagudem Taluq.													
54	Chagallu	1,210	12	..	11th do.	24th do. ..	156	..	650	..	624	..	2,600	
	VIZAGAPATAM DISTRICT.													
	Palcondah Taluq.													
55	Vadamah	4,000	130	..	21st July	17th November ..	1,209	..	2,500	2½	1,462	..	3,025	
56	Palcondah	..	50	..	..	..	563	..	..	..	..	..	..	

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
	VIZAGAPATAM DISTRICT—(*Continued*).												
	Vizianagaram Zemindary.												
57	Gunupur	26	..	..	..	..	275	..	..	..	..	..	..
58	Do	18	..	..	..	..	120	..	..	..	..	..	..
	GANJAM DISTRICT.												
	Aska Taluq.												
59	Aska	..	50	..	4th July ..	9th November ..	803	..	..	..	..	..	..
60	Do.	..	50	..	4th do. ..	Do. ..	680	..	..	..	..	..	..
61	Do.	..	16	..	27th do. ..	4th December ..	255	..	..	..	..	..	..
62	Do.	..	15	..	27th do. ..	Do. ..	233	..	..	..	..	..	..
	KURNOOL DISTRICT.												
	Koilkuntla Taluq.												
63	Boyalatadiparti ..	726	17	..	17th July	20th December ..	608	..	1,248	..	4,053	..	8,320
64	Vuppalur	2,480	85	..	18th August ..	11th do. ..	1,296	..	..	..	2,529	..	..
65	Timmanayanipettah ..	1,210	56	..	6th do. ..	10th do. ..	532	..	1,296	..	2,128	..	5,184
66	Tollamadugu	2,541	78	..	29th do. ..	15th do. ..	984	..	..	..	1,874	..	..
67	Hanumantagundum ..	1,161	17	..	8th do. ..	1st do. ..	351	..	..	..	1,465	..	..
68	Timmanayanipettah ..	1,391	54	..	26th do. ..	20th do. ..	372	..	..	..	1,294	..	..
69	Owk	2,057	54	..	14th September ..	18th January ..	510	..	..	..	1,200	..	..
	Nundial Taluq.												
70	Nundial	726	51	..	10th August ..	2nd December ..	324	..	528	3	2,166	..	3,520

71	Do.	3,509	125	..	28th July	..	28th November	..	1,276	..	4,320	..	1,761	..	5,959
72	Do.	1,210	28	..	18th do.	..	3rd December	..	376	..	..	2¾	1,505	..	..
73	Do.	1,597	47	..	5th August	..	20th do.	..	456	..	..	..	1,382	..	..
74	Do.	1,210	28	..	12th do.	..	29th November	..	342	..	..	..	1,368	..	..
75	Do. ..	1,597	35	..	26th July	..	26th do.	..	380	..	528	..	1,152	..	1,600
76	Do.	387	10	..	5th August	..	20th December	..	61	..	..	..	772	..	..
	Nandikotkur Taluq.														
77	Bizinivemula	968	22	..	13th August	..	26th December	..	446	..	..	..	2,233	..	..
78	Nandikotkur	726	17	..	12th do.	..	31st do.	..	247	..	..	..	1,647	..	..
79	Bizinivemula	2,226	35	..	13th do.	..	26th do.	..	674	..	..	..	1,467	..	..
80	Damagatla	968	16	..	5th do.	..	15th do.	..	216	..	..	3	1,080	..	..
81	Vaddemanu	5,337	92	..	27th do.	..	25th do.	..	1,160	..	1,500	3	1,052	..	..
82	Do.	1,452	16	..	13th do.	..	26th do.	..	266	..	..	..	887	..	..
	Patticondah Taluq.														
83	Bondimadugula ..	242	14	..	20th July	..	26th December	..	141	..	..	..	2,835	..	..
84	Jilladubudakala ..	1,210	48	..	5th August	..	4th January	..	480	..	..	4	1,920	..	..
85	Kotakonda	968	24	..	20th do.	..	19th do.	..	240	..	..	4	1,200	..	..
86	Karivemula	4,477	120	..	5th September	..	4th February	..	912	..	..	4	986	..	..
	Ramalkota Taluq.														
87	Yeldurty	1,210	30	..	2nd August	..	4th December	..	513	..	..	..	2,052	..	..
88	Do.	1,815	35	..	3rd October	..	..		622	..	..	..	1,659	..	..
89	Vudumalpad	4,840	77	..	9th August	..	5th December	..	885	..	..	3	885	..	..
90	Sudapalli	9,680	135	..	2nd September	..	..		1,230	..	..	3	615	..	..
	Sirvell Taluq.														
91	Chagalmarry	484	18	..	14th August	..	28th December	..	266	..	312	..	2,660	..	3,120
92	Do.	1,597	11	..	2nd do.	..	..		648	..	..	..	1,965	..	..
93	Do.	2,613	38	..	15th do.	..	28th December	..	484	..	..	..	897	..	..
	Markapur Taluq.														
94	Chapalamadugu ..	..	12	..	12th August	..	10th January	..	64	..	..	..	..	..	..
95	Yerragoodapallem ..	..	12	..	20th do.	..	3rd do.	..	78	..	..	..	..	..	..
96	Tripurantakum ..	..	6	..	12th do.	..	10th do.	..	72	..	..	..	..	..	..
97	Kowlacoontla	..	6	..	12th do.	..	10th do.	..	36	..	..	..	..	..	..

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
					KURNOOL DISTRICT—(*Continued*).								
	Cumbum Taluq.												
98	Yerrabollem	..	26	..	8th September ..	10th February ..	178	..	..	..	..	..	..
					BELLARY DISTRICT.								
	Hospett Taluq.												
99	Mudalapuram	1,540	28	..	2nd August ..	1st January ..	570	..	1,293	6	1,791	..	4,066
100	Hossoor	242	14	..	20th July	10th December ..	80	..	..	4	1,600	..	..
101	Hullirampuram ..	302	12	..	10th June ..	30th November ..	80	..	..	4	1,282	..	..
102	Kamalapoor	14,520	100	..	14th August ..	25th December ..	3,162	..	..	3	1,054	..	..
103	Do.	..	14	..	20th do. ..	28th January ..	242	..	324	3	..	..	..
104	Chitwadgi	514	12	..	5th July ..	25th November ..	110	..	..	3	1,036	..	..
105	Basapuram	605	12	..	1st August ..	30th do. ..	80	..	120	3	640	..	960
	Anantapur Taluq.												
106	Singanamulla	1,815	42	..	4th August ..	6th January ..	1,033	..	..	$4\frac{1}{2}$	2,755	..	..
107	Do.	1,815	42	..	4th do. ..	10th do. ..	944	..	..	$3\frac{3}{4}$	2,519	..	..
108	Bookarungasamudrum.	3,630	36	..	22nd do. ..	20th December ..	820	..	..	3	1,093	..	..
109	Anantapur	605	16	..	22nd September ..	4th February ..	131	..	..	3	1,049	..	..
	Bellary Taluq.												
110	Moka	3,388	19	..	23rd August ..	12th January ..	280	..	..	$2\frac{1}{4}$	400	..	..
	Huvinhadgally Taluq.												
111	Dombarahully ..	..	31	..	23rd August ..	14th December ..	508	..	500	3	..	..	..

	CUDDAPAH DISTRICT.													
	Madanapully Taluq.													
112	Kollapalli	3,630	92	..	17th January ..	23rd May ..	1,794	..	..	5	2,392	..	..
113	Do.	3,630	92	..	5th do. ..	18th do. ..	1,776	..	..	5	2,368	..	..
114	Do.	1,694	43	..	5th do. ..	16th June ..	388	..	..	5	1,109	..	..
	Cuddapah Taluq.													
115	Cuddapah	5,445	90	..	26th September ..	30th January ..	1,187	..	..	..	1,055	..	..
116	Do.	13,373	261	..	..	..	2,802	..	..	..	1,014	..	..
	MALABAR DISTRICT.													
	Palghaut Taluq.													
117	Akatetara	225	12	..	22nd May ..	20th October ..	148	..	..	..	3,184	..	..
118	Koppam	1,600	50	..	25th June ..	..	740	..	..	..	2,238	..	..
119	Aktethara	2,200	90	..	5th May ..	25th September ..	900	..	..	..	1,980	..	..
120	Do.	596	26	..	15th do. ..	18th October ..	227	..	..	3	1,847	..	..
121	Kattuseri	300	10	..	20th do. ..	20th October ..	54	..	150	4½	871	..	2,420
122	Puduchary	1,100	21	..	27th June ..	9th November ..	133	..	..	3	585	..	..
	Cherakal Taluq.													
123	Puyadi	698	16	..	..	20th October ..	255	..	..	3½	1,768	..	..
124	Kuttoor	1,800	45	..	28th May	28th do. ..	540	..	..	3	1,452	..	..
125	Kalliad Amshom ..	2,640	51	..	16th May ..	4th do. ..	768	..	..	5	1,409	..	..
126	Kalliad	3,324	46	..	22nd May ..	15th do. ..	599	..	..	5	873	..	..
127	Do.	2,300	44	..	17th do. ..	5th do. ..	224	..	..	..	433	..	..
	Kottayam Taluq.													
128	Perinkolam	560	16	..	8th June ..	7th do. ..	113	..	85	4	983	..	..
129	Do.	1,464	42	..	18th May ..	10th do. ..	240	..	..	5	793	..	..
	Wynaad Taluq.													
130	Ellornad	188	10	..	10th June ..	28th November ..	95	..	114	2	2,446	..	2,935

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed Sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
			Weight.	Measure.			Grain threshed.		Straw.		Grain threshed.		Straw.
							Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
							MALABAR DISTRICT—(*Continued*).						
	Ponany Taluq.												
131	Ishwaramangalam ..	1,360	10	..	13th April ..	10th September ..	291	..	494	3	1,036	..	1,759
							SOUTH CANARA DISTRICT.						
	Kasargod Taluq.												
132	Kalliyar village in Nileshwar Mogni ..	2,420	16	..	20th June ..	17th October ..	624	..	1,248	3½	1,248	..	2,497
133	Kottur village in Kavenad Mogni ..	2,420	15	..	24th do. ..	20th do. ..	624	..	1,248	4	1,248	..	2,496
134	Kodoth village in Paduvannad Mogni ..	3,388	32	..	18th June ..	16th do. ..	528	..	1,056	4	754	..	1,509
	Uppinangadi Taluq.												
135	Kadikar village ..	993	15	..	17th June ..	20th October ..	287	..	..	2	1,399	..	..
136	Do. ..	859	14	..	Do. ..	28th do. ..	106	..	..	2	597	..	..
	Udipi Taluq.												
137	Mudindambur village, Nidambur Magane ..	950	16	..	12th May ..	9th October ..	320	..	680	5	1,630	..	3,464
	Mangalore Taluq.												
138	Codiyalbail	3,267	99	..	20th & 24th June.	15th October ..	504	..	..	3	747	..	..

COIMBATORE DISTRICT.

	Coimbatore Taluq.													
139	Coimbatore	960	28	..	4th July ..	..	769	..	500	2	3,877	..	2,521
140	Oodanthoray	2,280	120	..	14th August ..	26th December ..	1,308	..	860	4	2,776	..	..
141	Coimbatore	600	12	..	5th September ..	22nd January ..	287	..	400	5	2,319	..	3,227
142	Do.	600	25	..	29th August ..	22nd do. ..	262	..	..	5	2,117	..	..
143	Do.	600	25	..	Do. ..	22nd do. ..	192	..	300	3¼	1,553	..	2,420
144	Do.	600	12	..	5th September ..	22nd do. ..	167	..	250	3¼	1,351	..	2,017
145	Do.	1,920	75	..	8th August ..	21st do. ..	525	..	937	2½	1,323	..	2,362
146	Chittarachavady ..	1,280	23	..	28th June ..	30th October ..	258	..	625	3	976	..	2,363
147	Odanthoray	4,000	78	..	23rd August ..	26th December ..	450	..	..	3	544	..	..
				..									
	Darapuram Taluq.												
148	Darapuram	100	13		7th July ..	..	67	..	..	3	3,243	..	..
149	Do.	400	23	..	31st do. ..	22nd November ..	194	..	..	3	2,347	..	..
150	Do.	400	11	..	15th September ..	14th January ..	172	..	..	..	2,081	..	..
151	Do.	700	33	..	14th June ..	24th October ..	253	..	..	3	1,749	..	..
152	Do.	400	13	..	27th November ..	4th April ..	108	..	..	2	1,307	..	..
153	Do.	400	13	..	7th August ..	..	97	..	..	3	1,174	..	..
154	Do.	600	16	..	5th July	..	140	..	..	3	1,129	..	..
155	Do.	700	27	..	18th June ..	27th October ..	162	..	..	3	1,120	..	..
156	Do.	400	13	..	16th July	8th November ..	81	..	..	3	980	..	..
				..									
	Pollachy Taluq.												
157	Marchinaigompolliem.	387	12	..	1st June ..	9th December ..	350	..	125	3	4,377	..	..
158	Anamallay	2,129	50	..	3rd May ..	..	1,500	..	..	3¾	3,410	..	..
159	Do.	532	20	..	20th July ..	27th December ..	300	..	200	3	2,729	..	..
160	Sunthagoundenpolliem.	3,193	100	..	15th do.	1st November ..	1,650	..	1,500	3	2,501	..	..
161	Do. ..	532	12	..	15th August ..	1st December ..	250	..	150	3	2,274	..	1,365
162	Marchinaigompolliem..	581	10	..	2nd January ..	9th May	235	..	150	3	1,958	..	..
	Sathiamungalum Taluq.												
163	Vaniputtur	1,600	20	..	2nd September ..	26th January ..	512	..	570	4½	1,549	..	..
164	Poodoopariyur ..	1,600	20	..	18th do. ..	2nd February ..	396	..	494	4½	1,198	..	..
165	Vaniputtur	600	15	..	29th do. ..	February ..	96	..	150	2¼	774	..	1,210
166	Puliyampattykarai ..	400	10	..	3rd October ..	10th February ..	64	..	100	2¼	774	..	1,210

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed Sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
	COIMBATORE DISTRICT—(*Continued*).												
	Oodumalapetta Taluq.												
167	Komaralingum ..	8,800	290	..	10th August ..	13th December ..	2,862	..	..	3	1,574	..	..
168	Do.	605	14	..	7th do. ..	3rd December ..	195	..	105	3¾	1,560	..	..
169	Valayapalayam ..	605	12	..	6th December ..	20th May ..	114	..	75	3	916	..	..
	Perindoray Taluq.												
170	Nunjakalambady ..	320	21	..	4th October ..	1st March ..	288	..	..	3¾	4,356	..	..
171	Dalavoypolliem ..	448	12	..	1st do. ..	4th February ..	330	..	600	4½	3,565	..	..
	Caroor Taluq.												
172	Neroor	1,600	27	..	18th November ..	28th April ..	216	..	393	3	653	..	1,189
	SALEM DISTRICT.												
	Trichengode Taluq.												
173	Coondelputty	968	12	..	Early part of July.	..	768	..	1,500	4½	3,840	..	7,500
174	Mattooputty	3,630	24	..	Early part of Aug.	..	1,843	..	3,750	4½	2,458	..	5,000
175	Comaramangalam ..	2,120	19	..	Early part of July.	..	230	..	450	3½	526	..	1,027
	Namkal Taluq.												
176	Mothalaiputty	1,210	24	..	1st October ..	20th January ..	405	..	..	4½	1,620	..	..
177	Kosavamputty	1,210	24	..	10th do. ..	10th February ..	337	..	..	5	1,350	..	..
178	Do.	605	18	..	5th do. ..	February ..	135	..	..	5	1,080	..	..

Tanjore District.

	Tanjore Taluq.												
179	Nadukávèri	3,200	120	..	10th June ..	22nd October ..	1,995	..	..	..	3,017	..	..
180	Kulimâttur	2,160	80	..	11th do. ..	21st do. ..	1,250	..	..	..	2,801	..	..
181	Tiruppayanam ..	2,080	78	..	15th do. ..	26th do. ..	986	..	..	..	2,295	..	..
182	Daivastanam Tingalore.	480	26	..	1st do. ..	30th do. ..	151	..	..	..	1,523	..	..
183	Mokasakarkudi ..	5,920	161	..	26th June ..	30th October ..	1,852	..	..	..	1,514	..	..
184	Kaduveli	3,200	75	..	25th August ..	30th December ..	700	..	..	..	1,059	..	..
185	Vencatasasamudram ..	2,080	60	..	22nd June ..	29th October ..	420	..	..	..	977	..	..
186	Vaurankudi	1,570	56	..	20th July ..	12th December ..	309	..	..	..	953	..	..
187	Perumpuliyar ..	2,420	37	..	1st October ..	26th January ..	237	..	..	..	474	..	..
	Combaconum Taluq.												
188	Palaiyarúkai	4,800	196	..	22nd June ..	25th October ..	2,205	..	..	..	2,223	..	..
189	Perumpadi	2,240	111	..	20th July ..	5th December ..	913	..	..	..	1,975	..	..
190	Sembangudi	1,600	111	..	3rd do. ..	12th November ..	650	..	..	..	1,966	..	..
191	Runganathapuram ..	2,016	78	..	22nd June ..	15th November ..	748	..	..	..	1,796	..	..
192	Nermelikudi	4,000	157	..	20th June ..	6th October ..	1,024	..	..	..	1,239	..	..
193	Veppattur	3,200	78	..	23rd July ..	19th December ..	406	..	..	..	615	..	..
	Mannargudi Taluq.												
194	Mannargudi	822	98	40	..	..	492	200	..	..	2,897	1,178	..
	Trivadi Taluq.												
195	Trivadi	1,200	50	20	12th June ..	1st October ..	608	247	..	..	2,452	996	..

Trichinopoly District.

	Perambalur Taluq.												
196	Perambalur	242	12	4	9th September ..	6th February ..	150	..	..	..	3,000	..	..
	Woodiarpolliam Taluq.												
197	Arealúr	4,840	58	..	15th July ..	7th December ..	1,360	..	..	$3\frac{1}{2}$	1,360	..	..

RESULT OF CAROLINA PADDY EXPERIMENTS MADE IN THE MADRAS PRESIDENCY—(*Continued*).

Number of Experiment.	Taluq or Village.	Area.	Seed Sown.		Date of Sowing.	Date of Reaping.	Yield per Plot.				Yield per Acre.		
							Grain threshed.		Straw.		Grain threshed.		Straw.
			Weight.	Measure.			Weight.	Measure.	Weight.	Length of Straw.	Weight.	Measure.	Weight.
		SQ. YDS.	LBS.	MADRAS MEASURES.			LBS.	MADRAS MEASURES.	LBS.	FEET.	LBS.	MADRAS MEASURES.	LBS.
	TRICHINOPOLY DISTRICT—(*Continued*).												
	Trichinopoly Taluq.												
198	Koohur	4,840	120	..	9th September ..	6th February ..	1,224	..	..	..	1,224	..	..
	Musery Taluq.												
199	Musery	1,694	33	..	19th August ..	2nd January ..	171	..	400	2¼	489	..	1,143
	MADURA DISTRICT.												
	Pulney Taluq.												
200	Pulney	355	46	..	6th October ..	21st March ..	231	..	..	3	3,149	..	..
201	Iyempully	355	27	10	5th October ..	2nd Februay ..	146	54	..	..	2,004	..	..
202	Thamaraycolum ..	711	27	10	11th September ..	29th January ..	293	108	..	..	2,001	..	..
	Dindigul Taluq.												
203	Balakistnapuram ..	966	30	..	4th September ..	20th do. ..	567	..	1,618	3¾	2,840	..	8,107
204	Seelapady	1,111	12	..	10th do. ..	10th February ..	540	..	..	4	2,352	..	..
205	Balakistnapuram ..	4,840	36	..	25th do. ..	1st do. ..	1,320	440	..	4	1,320	..	..
	Madura Taluq.												
206	Kolamungalum ..	622	16	6	4th October ..	25th do. ..	95	..	..	..	740	..	..

27. The foregoing statement, includes only the results of experiments that appeared to have been conducted under fair average conditions, and were on a scale sufficiently extensive to afford data of practical value. The difference in the results tabulated, must be attributed to the varying conditions of soil, irrigation, and tillage, under which they were obtained, and not, to any appreciable extent, to the climate of one part of the Presidency being more suited, than that of another part, for the growth of this variety of paddy. Though, there is a wide difference between the climate of South Carolina and, the climate of the Madras Presidency, this difference, does not appear to have influenced the growth of the paddy in this country, the results from acclimatized and, imported seed, having differed but little. Throughout the wide range of country over which the experiments were spread the yield, almost everywhere, was satisfactory when the proper conditions of soil and tillage were met with. The yield of grain per acre was, in several instances, higher than the average yield of an acre in South Carolina. It is true, that in the majority of the experiments the yield was unsatisfactory, but this applies equally to the country paddy crops reported on.

Over the country generally more poor crops than good crops.

The fact is, throughout the country, there are a much greater number of indifferent crops produced, than of good crops. It is only when the individual history of each crop is searched out and recorded, as was done in the case of most of the Carolina paddy experimental crops, that the fact, that there are so many bad crops raised, is brought into prominence. The following extract from a report by the Collector of Cuddapah affords information on this question:—

"The abundance of produce was, of course, proportionate to the fertility of the soil; in regard to the little success that attended the efforts of a few Ryots in some localities, I have only to observe that it was owing to the sterility of the soil or to the crops having been destroyed by blight."

Yield good in several instances.

28. In some instances the general results of the experiments were very satisfactory: thus;—

"The outturn exceeded by one-third the average yield of the adjoining land under indigenous paddy."

"The yield he describes as treble that of the ordinary paddy, while the straw is half as high again."

The Collector of Malabar remarked:—

"Marked success attended the experiments in several instances; the failures in a few, and want of success in others, is attributable to accidents, to which all crops are liable, as too much or, too little rain, attacks of insects, &c."

The Collector of North Arcot wrote:—

"The result of the experiment I consider to be most satisfactory and proves that the Carolina paddy is a cereal well suited to this country which thrives splendidly without requiring more skill or care in the cultivation than the commonest grain."

The Dewan of the Travancore State wrote:—

"From the result of the experiment we may, I think, safely conclude that the soil of Travancore especially in the Northern Districts is well adapted to the growth of the new species of paddy, the grains of which are decidedly superior in quality to the common produce of the country."

29. There is a considerable difference, in the opinions expressed regarding the quality of the rice, of the Carolina paddy, raised in the experiments. Before proceeding to notice these opinions, it is as well to observe, that in the Madras Presidency nearly the whole of the rice, for local consumption and export, is prepared by the pestle and mortar, worked by women; no machinery being used. The common practice, is to boil the paddy and, after the interval of a day or two, during which it is dried by exposure to the sun, to subject it to the husking operations. A considerable quantity of paddy is, however, husked without being boiled. The process of husking is very rude and tedious, and the rice has a very poor appearance, compared with that of rice prepared in rice mills. Imperfect though the process is, it is cheaper, than that by which rice is prepared in mills

Quality of the rice.

in America. It is only in appearance, that the rice fails; for, this apparent defect, is an advantage from the consumer's point of view, for, in the effort to render the sample agreeable to the eye, the milling process removes from the rice some of its most nutritious portions, those in which the albuminoids are chiefly to be found.

30. The following extract, from an Annual Report of the Superintendent of Government Farms refers to two samples of rice, forwarded to England for valuation, being the produce of Carolina paddy produced on the Sydapet Experimental Farm:—

"89. Parcel A was prepared from 8 Madras measures of Carolina paddy and consisted of $3\frac{3}{4}$ Madras measures of clean rice. Messrs. Walker and Co. were good enough to have the paddy husked in the way that it is usual, in Madras, to husk all paddy, intended for export to England. The 8 measures of paddy, yielded as follows:—

	By volume. Per cent.
Clean rice fit for the Home market	46·87
Broken rice	3·13
Husk and wastage	50·00
Total ..	100·00

"With reference to this result, Messrs. Walker and Co. wrote to me:—'We are not very well satisfied as to the result of the husking; the grains are more broken than is desirable, but the coolies say they found it more difficult to husk the paddy than the ordinary native grain.' With reference to the cost of husking, they wrote:—'The cost of husking the 8 measures is 1 anna, and we can contract at this rate for all you intend sending to England. In the same letter they remarked: 'the wastage on this 8 measures may be taken as a fair average.'

"90. Parcel B consisted of 623 pounds of cleaned rice prepared from 448 Madras* measures of country-raised Carolina paddy. In addition to the clean rice there were $24\frac{3}{4}$ measures of broken rice, the value of which was, in Madras, one anna per measure.

"91. The following letter refers to parcel B:—

'DEAR SIR,—We now wait on you with our broker's report and valuation on the four bags of rice sent to London on your account by S.S. *Sultan*, and we trust the report will be considered satisfactory. We may mention that while your rice is valued at 10*s*. $4\frac{1}{4}$*d*. to 10*s*. 6*d*. per cwt., *ordinary* Pinky was sold at 9*s*. 6*d*. to 10*s*. $7\frac{1}{2}$*d*. for *good*.

(Signed) WALKER AND CO.

'*Broker's report on four bags* G.F. *of rice per "Sultan."*

W. & Co.

R.

'The rice proves to be very fine white grain, and in quantity would command 10*s*. $4\frac{1}{4}$*d*. to 10*s*. 6*d*.; it is different from what is known as Pinky, and we doubt if the starch-makers, who are the largest consumers of this particular sort, would like it so well, but for cleaning purposes it would meet a ready sale.'

"92. The rice was sold in London in the usual way; the price realized, 11*s*. 6*d*. per cwt., was only a trifle higher than the price ruling at the time for ordinary Madras rice. This result, was somewhat disappointing; judging from the value generally put upon Carolina rice in London, I had anticipated a much larger price than was obtained.

"93. It is, I think, probable that the very high price that Carolina rice imported from America commands in England is due chiefly to the very superior way in which it is prepared for market. The Madras-grown Carolina paddy, from which the rice (Parcel B) was prepared, was, as far as I can judge, quite equal in quality to the

* 104 cubic inches.

Carolina paddy which was imported into this country from America and which, was the seed from which the paddy in question was raised. In Madras, the husk merely is removed, there is no attempt to remove the dark-colored surface which is found immediately beneath, and very little is attempted in the way of sizing the grain, the whole process, such as it is, being performed by women by means of a pestle and mortar and a bamboo sieve."

31. Dr. Thompson, who made some interesting experiments in Chingleput and in Tinnevelly with Carolina paddy, gives the yield of rice, he obtained from Carolina paddy and two indigenous varieties of paddy as follows :—

	Weight per Madras Measure.	Weight of Rice obtained.
	oz.	oz.
Manawari Sumba paddy ..	42·50	32
Car paddy	42·25	32
Carolina paddy	43·50	32·50

32. As regard the estimation in which the Carolina rice is held by Natives, the following extracts will afford information ;—

" I gave some of the paddy to Brahmins, and they informed me that there is less loss in removing the husk than in the ordinary paddy and that it is far superior as an article of food."

" The rice is far superior in color, size, and flavour to any of the country kinds that can be produced within the same short time ;"

" that the Carolina rice is superior to the best of the rice staples of the country is not now denied ;"

" the rice of Carolina paddy is decidedly much superior to that of the ordinary paddy ;"

" it is perfectly white in color and when dressed for food is of good taste. In quality it is equal, if not superior, to Peshanam paddy grown in the neighbourhood of Nellore and which is considered to be the best paddy in this district ;"

" the quality of the rice is equal to that of the ordinary kind, but not equal to Siroomony and other superior kinds ;"

" the grain is larger and coarser than that used by well-to-do people. The grain is however less liable to break in husking than that of ordinary paddy ;"

" the rice produced is larger, more translucent, and altogether nicer-looking than the Manawari Sumba and weighs 1½ oz., to the measure heavier."

" The Carolina rice, though a large grain, is white, a quality which no other kind of paddy possesses ; its taste when boiled is not inferior in flavour to Sumba and Mellaghi."

33. From these extracts, and others that might be given, there can be no doubt but that, the rice, prepared from the Carolina paddy raised in this country, was really excellent, and superior to much of the rice produced in this country. The flavour of the rice, when cooked, will depend greatly upon the character of the soil upon which the paddy was raised.

34. The London valuations, of the samples of Carolina rice, from Madras-grown Carolina paddy, were certainly not encouraging, but, as was noticed in the extract given, it is very probable that the low value put upon the rice was, in consequence of its unsatisfactory appearance, due to the imperfect way in which it was prepared.

London valuation of Madras-grown Carolina rice not encouraging.

General opinions and observations regarding the crop.

35. The Deputy Collector of Arealur reported :—

" Upon the whole I am satisfied, from the two experiments I have already made that, Carolina requires no extraordinary care in its cultivation ; like the country Car, it can be easily grown without entailing any extra expense ; and the profit, to the Ryot, I have no doubt, would be much greater than what he would obtain from the country paddy."

The Acting Sub-Collector of Salem, in submitting his report, remarked :—

"I am convinced that the Carolina paddy is far more productive than any of the indigenous kinds, and that it is so has been shown by my first experiment."

The Acting Collector of Malabar wrote :—

"The experiments were, I think, pretty successful considering the ignorance of the individuals who made them with regard to the best mode of cultivation and the best soil adapted to the growth of the plant. All soils have been tested—common rice lands, garden land, and dry paremba lands. The seed was sown broadcast and in beds, and the plants were in some instances transplanted, and in others left in the beds in which they were first sown."

The Collector of Salem wrote :—

"The peculiarities which I observed in the Carolina crop are—

"1*st*.—That it grows and ripens much faster than the ordinary country kind.

"2*nd*.—That the stalks are thicker and better able to stand the weight of the ear than the country paddy; it contains a larger number of grains. The country paddy stalks being very thin they bend, and the consequence is that much of the grain is lost on the ground before the crop is cut."

The Deputy Collector of Naidupet wrote :—

"The Carolina paddy has this advantage over the Peshanum (the best paddy in the Nellore District), that it is a plant of only 4 months' growth, whereas the Peshanum requires fully 6 months to come to maturity, and it (Carolina paddy) would beyond doubt fetch as good a price in the market as the Peshanum owing to the superior quality of the rice."

The Agent of the Shivagunga Zemindari wrote :—

"I do not hesitate to say that the Carolina paddy has the following advantages over the best descriptions of paddy, viz., Mellaghi and Sumba, grown in this zemindari :—(1) It reaches maturity in 4½ months and like the Mellaghi and Sumba which are ripe for the sickle only after the lapse of 6 months; (2) the outturn of Carolina paddy is much larger than that of Mellaghi and Sumba; and (3) the yield in straw is most abundant * * * * *. The grain does not drop off readily when the crop is cut or when removed from the field to the threshing ground, so that there is no such waste as there is with the other descriptions of paddy. The grain is perfectly formed; there are few if any empty shells or husks. The plant grows most vigorously, and it would appear that it does not require so much water as indigenous paddy to bring it to maturity."

The Superintendent of Government Farms in his annual report for 1871-72 wrote :—

"Paragraph 36. I report these results as showing how the one variety of paddy will grow and even thrive under circumstances that would be highly prejudicial to the other; but, from this, we are not to infer, that the former (the country) is the better variety of paddy, though, for such specially *unfavorable* circumstaces it is, undoubtedly, the best * * * * *. The fact is, unimproved varieties of plants, like unimproved breeds of animals, suffer less, when opposed by unfavorable circumstances, than do the more highly developed. Carolina paddy, is an improved variety of paddy, which has been carefully reared on the rich virgin soils of South Carolina. Our last year's experience proves, not only that remunerative crops of country paddy, can be produced on a soil that altogether fails in producing a fair crop of Carolina paddy, but also, that a soil which one year produces good crops of this grain may, in the next year, not be able to produce even half a crop. Thus soils which, in 1870, yielded as much as 40 bushels per acre of Carolina paddy, yielded last season only half as much, though, equally as well cultivated and manured, but, the explanation of this is simple; the soils which produced such good crops of Carolina paddy in 1870, were in a fresh state at the time the paddy was sown; they had not been under wet cultivation for several years; while, those sown last year with this paddy were under wet cultivation in the *previous* year, and had become reduced by the stagnation of the irrigating water in the soil, to the condition of the more inferior descriptions of paddy land, that is, to a sour, unhealthy, soapy condition, in which atmospheric agencies could have no

effect for good, in which plant food is either locked up and rendered inert, or forms combinations more or less injurious to vegetable life, but with a surface to the depth of two or three inches in more or less healthy state. It is easy to understand why, on a soil in this condition, Carolina paddy seldom does well, while country paddy may thrive. The former feeds deep down in the soil; it has long deep roots varying in length, under average circumstances, from four to six inches, while few of the rootlets are horizontal. It is very different with the roots of country paddy; nearly the whole of its rootlets radiate over the surface of the ground at right angles to the stem of the plant. They are seldom more than two or three inches in length, and are so interwoven as to form a sort of net-work well suited for supporting the plant on the semi-liquid mud in which this paddy is usually cultivated. Hence, a soil in a bad physical state, if it only has a healthy surface two or three inches in depth, may produce fair crops of country paddy, though, it will entirely fail in producing a crop of Carolina paddy. On such a soil, the Carolina paddy would start as well as the country paddy, and, would continue to grow as well *until its roots began to penetrate below the aërated soil*, when, its growth would be checked and it would gradually turn yellow and sicken. The fact is, Carolina paddy cultivation, belongs to a higher condition of agricultural practice, than has yet been reached in this country."

Less water needed by Carolina paddy.

36. The opinions of the Experimenters agreed generally, as to the smaller quantity of water needed by the Carolina plant than for the country paddy plant, and the opinion was also equally generally held that the Carolina crop suffers less, than does a crop of country paddy, when temporarily deprived of irrigation water. If, as has been shown to be the case, in several instances, the roots of the Carolina paddy plant feed deep down in the soil, while those of the country paddy plant feed in the surface soil; it is easy to understand why the former suffers less than the latter, when irrigation water is temporarily withheld. The following extracts confirm this view;—

"It (Carolina paddy) is not so much affected by a temporary failure of water as the indigenous plant."

"It requires certainly not more than one-quarter of the water necessary to produce an ordinary crop."

"Much water is injurious rather than beneficial."

"Carolina paddy is very injuriously affected by heavy rains during the first six weeks of its growth."

"I think it is very essential that the beds should be kept constantly flooded during the formation of the grain; on the other hand during the second month as little water as possible should be given."

"I am of the opinion that high lands are more suitable than low lands for the culture of Carolina paddy."

"Lighter and friable soils produced the best results."

"Where the soil was too clayey and impervious the plants did not succeed."

"Paddy land of a retentive character situated at a low level, resting on a stiff sub-soil through which there is no natural drainage or filtration, invariably becomes sour and unhealthy, after producing a crop of paddy, conditions quite opposed to the successful cultivation of Carolina paddy."

"I find that clayey lands are not well adapted for the cultivation of Carolina paddy."

"Excess of water in the land proves injurious to the crop."

Good tillage needed for Carolina paddy.

37. A number of the Experimenters agree as to the necessity for the more perfect tillage of land for Carolina paddy than for country paddy.

"Its cultivation is said to entail upon the Mirassidars more labor than country varieties; the land requires to be ploughed deeper."

"This cereal must have a deep cultivated soil."

"The want of success in the cultivation I attribute entirely to shallow ploughing."

"A very much greater crop of Carolina paddy can be obtained under high cultivation than of country paddy."

On the other hand, some Experimenters assert that the country paddy requires a much more elaborate preparation of the soil, than Carolina paddy, because, while the Carolina paddy sends its roots further in search for food the roots of the country paddy plant are always near the surface of the soil, and therefore have a more limited feeding area.

Reasons for failures in experiments.

38. Many reasons are given for the failures that have attended so many of the experiments.

"There is I fear too much reason to believe that Natives to whom the paddy was distributed were rather disposed to report unfavorably upon it, fearing that Government, on becoming aware of the heavy crops that can be raised on their land, should determine to raise their rents in proportion."

"The experiments seemed to have been unpalatable to the Mirassidars generally."

"I believe also that the cultivation did not receive proper attention from the Ryots. They do not approve of the condition to give up one-fourth of the produce yielded."

"The reasons generally given for unsuccessful results in all these cases are deficiency of rain in the early part of the season and to much rain in the latter part of the season."

"Much of the seed supplied was evidently inferior."

"Hares injured many plants, and rats and birds ate up most of the grains."

"A large portion of the plants were destroyed by cattle."

"A flood came and washed away greater part of the plants."

"Unfortunately three-fourths of the plants rotted from being inundated."

"When the plants were in ear a storm occurred and injured them."

The Deputy Collector of Naidupet remarked :

"Convinced as I am that the Carolina did not yield a crop commensurate to the care and labor bestowed on the plantation, my eyes are not shut to the fact that several of the Vadasamba fields similarly situated have shared the same fate, and the produce in some cases was even worse, although the fields sown a week or two earlier or later, and which have thus escaped the heavy rains at the earliest stage of the plantation, have thrived better."

There cannot be any doubt but that by much the largest number of experiments failed from such causes as are mentioned in the preceding extracts, causes which would have proved equally detrimental to country paddy similarly circumstanced.

39. Where country paddy is grown, care is taken that the sowings shall take place at the season of the year that is the most appropriate, when ploughing and watering can be most satisfactorily performed. But, the Carolina paddy in many experiments, was sown at unseasonable times, and under circumstances that would not have been favorable for country paddy. In some instances, this was caused by delay in receiving the seed, but in many cases there are good grounds for believing that the real reason why the Carolina paddy was exposed to unfavorable conditions by many Ryots was a desire, on their part, that the experiment should not afford, information, by the aid of which the fertility of their land could be ascertained.

Cultivators suspicious regarding object of experiments.

40. It was perhaps, but natural that the Ryots should view with suspicion, any course of action suggested by Tahsildars, or Revenue Inspectors, the officials who have so much to do with the fixing of the amount of the rent. If, the arrangement described in the following extract, was at all generally followed, in dealing with Carolina paddy Experimenters, it is not to be wondered at that the experiments were unpopular :—

"I propose that an agreement should be taken from the Ryot consenting to this experiment (Carolina paddy) in which the number of the field, area, and nature of soil might be entered and a condition added, that after the crop becomes ready for the sickle, he will cut and keep the same in the possession of a Revenue Inspector who will be deputed for that work by the Tahsildar; and that, he will render me an accurate account of the expenses incurred by him from the beginning to the end of the experiment; and that, the paddy shall be threshed and cleaned before the Revenue Inspector who would give an account to the Tahsildar."

That in many instances the Ryots did not give true returns is evident from the facts noticed in several of the reports. For instance ;—

" The Ryot to whom the seed was given for experiment reported an outturn of 22 measures but now, he admits the outturn was 250 measures. He had, it seems, concealed the facts, fearing that half of the produce would have been taken from him, as the Government share."

The Collector of South Arcot, in submitting this case to Government remarked ;—

" The information disclosed in this letter illustrates the peculiar genius of the native Ryot, and shows, how strange are still the idiosyncracies of the cultivating classes generally, in regard to their position with, and treatment, by the Government ; and, it seems almost incredible that in the present day, and with all the means of intercourse with European and educated native officials enjoyed by the people, any, but the most boorish and uncivilized, should be found to express the sentiments entertained by the Ryot Kistniah, who, to avoid being overreached as he thought, by the officers of Government, has attempted to deceive, by rendering a false account of the results of his experiment with the Carolina paddy seed given to him freely for testing its comparative value with the common paddy of the country."

41. That in many instances, the Ryots entered upon the experiments with great hesitation and suspicion is evident, from the frequent references to this state of feeling in so many of the reports, thus ;—

" I have explained to many persons during the past year that no enhancement of the assessment is contemplated on the introduction of Carolina paddy, an announcement which was received with evident relief."

" The illiterate Ryot has no faith in the production of this foreign cereal ; if he undertakes at all its cultivation, it is because he was told to do so by the Tahsildar or the Revenue Inspector. The wealthy Zemindars and Land-owners are equally indifferent to all agricultural improvement ;"

"———— is entitled to much credit for the interest taken in the experiment by him in spite of the odium he had to endure."

42. It was feared that, in the climate of Madras, the Carolina paddy would gradually deteriorate ; but, it appears to have great power in adapting itself to the varying conditions of the climate of this country. No deterioration in the quality of the grain does appear to have occurred to any appreciable extent, when the crop has been grown under suitable conditions. Regarding this, the Superintendent of Government Farms in a report to the Board of Revenue wrote ;—

Climate of Madras not unsuited to Carolina paddy.

" Carolina paddy, which has been grown in this country under suitable circumstances, is in no way inferior to the seed imported from America. One of the best crops I grew last season, 2,000 lbs. per acre, was from seed in the third generation since imported ; and, I have just issued a fine parcel of grain (the fifth generation) the produce of seed, which formed part of the yield of that crop, which was quite equal to the seed we imported from America. Deterioration does undoubtedly take place when the crop is grown under unfavorable circumstances, but it must be remembered that all our cereals deteriorate if sown, at the wrong season, on exhausted, or imperfectly-cultivated, soils. But, deterioration is less to be feared than, *the loss of purity in the sample ;* fully 50 per cent. of the samples of country-grown Carolina paddy, that have been forwarded to me, contain indigenous paddy, varying in amount *from 10 to 50 per cent.* The presence of this country paddy, amongst the Carolina grain, is altogether due to the late period in growth at which Ryots harvest their paddy ; they generally wait until the crop is *dead* ripe, when from 10 to 15 per cent. of the grain is shed by the wind, and in the harvesting of the crop, the result being, that after the removal of a crop of country paddy, the soil generally is sufficiently well seeded for another crop."

Carolina paddy seed largely mixed with country grain.

And on the same subject the Deputy Collector of Naidupett remarked :—

" I should not fail to bring another fact to your notice that when the crop was in ear, it was found that there was a large mixture of Vadasamba in all the fields

It was therefore evident that the Ryot, to whom I had entrusted the seed, had not taken proper care in securing it. He says, there must have been a mixture of some seed of Vadasamba in the field sown in 1871, and that, it has multiplied itself largely in the crop of that year, and, as the seed for the experiments of 1872 was selected from that crop, the admixture, is greater in the present crop."

Carolina paddy will degenerate if not grown under suitable conditions.

43. The Carolina paddy will certainly degenerate in this country and revert towards the type of the species from which it originated if, it is grown under less favorable conditions of soil manure or tillage than in America.

Pure Carolina paddy seed cannot now be got in Madras.

44. Though a very large quantity of Carolina paddy has been raised in this Presidency, there are grounds for believing that, at present no pure seed can be obtained in it in any quantity. Recently, every Collector was asked to furnish a supply from his District and, by none of the Districts could any pure seed be supplied. This may have been due to the Ryots not caring to part with the seed but, such an explanation is improbable, seeing that, liberal prices, would have been paid for it.

45. It was supposed that the Carolina paddy would hybridize with indigenous varieties of paddy, but, in this Presidency there is no direct evidence that this has occurred; though, when Carolina paddy is growing side by side with country paddy and, both are in flower at the same time, it is not at all improbable but that they may hybridize. But, if the general disappearance of *pure* Carolina paddy seed in this Presidency is, in any way to be attributed to hybridization, the result, though not what was anticipated, or, hoped for, will not be altogether without benefit. Though, the absence of pure seed is unsatisfactory, as regards the introduction of the Carolina paddy crop into this country, in view to the production here, of a rice for export equal in quality to that exported from America, there can be no doubt but that, the introduction of such a large quantity of good seed has been attended with benefit to our agriculture.

If hybridization has occurred the country paddy will have been improved.

46. The introduction of a new agricultural crop, is attended with difficulties in all countries; in India, those to be encountered, are perhaps greater than in any other country. However, had the same interest been taken in all the experiments, that is so noticeable in the reports of several, the general results would have been very different, to those obtained.

47. In dealing with a class of people, so ignorant and suspicious as is the cultivating class in this Presidency, it is not good policy, to entrust the introduction of new crops to officers whose duty it is to collect the land revenue. As long as the annual rent is practically unfixed, and depends in amount greatly upon the views held by these officers, so long will the Ryots view with suspicion any course of action they suggest. Further, seeing that, the rent is assessed by the Settlement Department on the results of field experiments, differing but slightly in character to the Carolina paddy experiments, it was not to be expected that the Cultivators would discern the difference; and hence, they would not attempt to remove, or ameliorate any drawbacks which the experimental crops might encounter.

Agricultural experiments troublesome and costly.

48. But, there is still another reason, to which the non-success of many of the experiments may be attributed, viz., *the trouble and expense that attends the carrying out of a field experiment.* To this subject, the following extract from a report by the Superintendent, Government Farms, refers;—

"Heretofore far too much has been expected from this annual expenditure of about one thousand Rupees on the distribution of seed. Ten or a dozen experiments are expected from each of the nineteen Collectorates. Agricultural experiments are costly and troublesome. Those unacquainted with the actual details of Farm Management, have not the least idea, how work is delayed (often during a very wet harvest when every moment is so important) by the necessity of carefully reaping, carting, weighing; housing, drying, weighing; threshing, weighing, &c., the produce of one or more

experimental plots, it often has been a cause of wonder to me, that the Ryot should put himself to so much inconvenience and loss, in conducting our experiments, seeing that, in so very few instances does he really understand the object of the experiments; and, it is not in the least surprising, that in the majority of cases, he secures his regular crops first, and leaves the experimental crops to their fate. I would very strongly advise, that, not only should the distribution of good seed be continued, but that, the practice should be very greatly extended; but, instead of issuing the seed, as at present, to a certain number of Ryots in each Collectorate would invite volunteers to come forward to make the experiments; it may, I think, be accepted as a fact, that if we cannot get volunteer agents to make our experiments, that those made by unwilling agents will possess but little value. With a view of repaying the Ryot, for his trouble and expense and stimulating his energy, I would suggest that small prizes, varying in amount from 20 to 50 Rupees should be offered for the best crop and best report (simple details of culture and observations) of any particular crop it is desirable to introduce into a new locality. Our great English Societies find it necessary, to offer medals and pieces of plate varying in value from 20 to 50 Guineas, to effect the same object; and if, this is necessary in England, in the present day, it must be much more so in this country with its backward civilization and wretched agriculture."

49. The suggestions, made in the preceding extract, met with the general approval of the Board of Revenue and, the Superintendent of Government Farms was directed to submit the outline of a scheme for giving effect to some of his proposals. From the scheme submitted the following extracts are taken;—

"2. Probably the most convenient arrangement would be to limit competition for these special prizes to certain tracts of country, and to select a fresh tract annually. The groups of districts adopted by the Board seem well suited to form the areas of competition. The group denominated East Centre, which includes Madras, Chingleput, North Arcot, and South Arcot, should, I think, be the first selected. The Madras District contains but a small area of agricultural land; still, as much of its wet land is generally well situated as regards position and manure, for Carolina paddy cultivation, it seems desirable that the same inducements should be offered in it as in the other Districts.

"3. The prizes, to be offered for competition in this group, might be as follows:—

					RS.
Four first-class	prizes,	50	Rupees	each	200
Eight second-class	„	25	„	„	200
Sixteen third-class	„	12½	„	„	200
Thirty-two fourth-class	„	6¼	„	„	200
Four Tahsildars'	„	50	„	„	200
				Total ..	1,000

"4. Each District in the group will thus have allotted to it: one Tahsildar's prize, one first-class prize, two second-class prizes, four third-class prizes, eight fourth-class prizes. The Tahsildar's prize should be awarded to the Tahsildar in whose Taluq the largest area of Carolina paddy is grown during the year. The other prizes should be awarded to the growers for quality of produce.

"5. A better way would be to give the prizes for the *best crops*, but this could not be done: the Collectorates are far too extensive, and the means of transit too imperfect, to allow of isolated plots of Carolina paddy in distant parts of the Districts being inspected; but, as matters improve, smaller areas of country, even Taluqs, may be selected, and prizes offered for the *best crops* within these areas. We should, I think, first deal with groups of Districts, next with Districts, and finally with Taluqs. I should certainly prefer to reverse this order of arrangement, but the demands for immediate action in *all* parts of the Presidency are too pressing to wait the action of the *slower*, though certainly more certain way of producing the desired result.

"6. My proposal is, therefore, that, during the period ending on the last day of April 1874, competition in the cultivation of Carolina paddy should be invited in the

section of country known as the East Centre, and that the inducements to be offered should be the prizes detailed in paragraph 3 of this letter, to be awarded under the following conditions:—

(1.) That each entry consist of, at the least, 200 lbs. of the unthreshed crop in the sheaf, and 100 lbs. of the clean grain.

(2.) That the whole of the produce exhibited under each entry shall have been cultivated and produced by the exhibitor.

(3.) That the crop of which the entry is a part shall have been grown on, at the least, 1,000 square yards of land.

(4.) That each entry be accompanied by a statement showing details of cultivation and general results (to be entered in a form to be provided) with simple observations made during the growth of the crop, the accuracy and value of which will receive due weight in awarding the prizes.

"7. Every facility should be offered for obtaining seed, which should be supplied to applicants free of all cost; and suggestions for cultivation should be freely distributed, though it should be thoroughly understood that it will be more satisfactory in every way if each competitor will do exactly as he thinks best in cultivating the crop.

"8. If these proposals are allowed to form a part of the general scheme for agricultural shows, the other details might be disposed of in Committee.

"9. I would add that it would be well, I think, if for a year or two, or until a demand is created, Government would purchase for export all the Carolina paddy of good quality produced in this part of the Presidency. I believe that the growers would be satisfied with a price slightly over the price obtained for ordinary country paddy; and, with the means at disposal here, the arrangement could, I think, be worked at very little expense to Government. At present there is no local demand for this paddy, and the samples are so irregular and of such a small bulk that no merchant considers it worth collecting for export.

"10. Carolina paddy will certainly never entirely displace the ordinary native varieties of paddy, though, in some situations and under some circumstances, it may make its way amongst cultivators, if only a market for it existed.

"11. I offer these suggestions, as something in this direction might be done in connection with other means to be tried to introduce this variety of paddy into general cultivation. If Carolina paddy is ever to become a staple production of this country, it must be introduced by other means than simply broadcasting good seed over the country. There is too much of doubt and uncertainty connected with experimental crops for incomes so precarious as those enjoyed by our Ryots."

Regarding the foregoing the Board of Revenue observed:—

"Mr. Robertson suggests in the letter before the Board a modification of the system now found so successful by the Royal Agricultural Society and others which seek the improvement of agriculture by offering prizes and holding competitive exhibitions, viz., that of confining their attention periodically to a limited and well-defined and similar area at a time, and changing those areas in such a manner that the whole country comes consecutively under the operation and attention of the Society.

"2. Mr. Robertson proposes to take up the East Centre District, and confine attention to Carolina paddy. The Board consider the proposals sound and worthy of adoption; the prizes are well classified and conditioned, and they would accept them for a year's trial.

"3. But Mr. Robertson has hit the real difficulty in extending the cultivation of this improved grain. There is no local taste or demand for this new specie of rice, and it is not grown in sufficient quantity to find a place in the market."

Government approved generally of the proposals, but objected to supply the seed gratis, to purchase the paddy produced, or to give prizes to Tahsildars, and, directed that, Mr. Robertson's proposals should receive a trial for one year. Accordingly the following Notification was published:—

"NOTIFICATION.

"With a view to encourage careful husbandry, the Board of Revenue have obtained the sanction of Government to the grant of prizes in four Districts during the current year.

"The Districts will be Chingleput, Madras, North and South Arcot.

"The prizes will be given for the best crop of Carolina paddy, and will consist of one prize of 50 Rupees, two prizes of 25 Rupees each, four prizes of Rupees 12-8-0, and eight prizes of Rupees 6-4-0 in each of the above four Districts.

"The following are the conditions of the competition :—

"1. That each entry consist of, at the least, 200 lbs. of the unthreshed crop in the sheaf, and 100 lbs. of the clean grain.

"2. That the whole of the produce exhibited under each entry shall have been cultivated and produced by the exhibitor.

"3. That the crop of which the entry is a part shall have been grown on, at the least, 1,000 square yards of land.

"4. That each entry be accompanied by a statement showing details of cultivation and general results (to be entered in a form to be provided) with simple observations made during the growth of the crop, the accuracy and value of which will receive due weight in awarding the prizes.

"Ryots and others desiring to compete may obtain seed on payment of the cost, which will be the market-price of good country paddy, through the Collector of their District, from the Superintendent, Government Farms. They should apply as soon as possible to the Collector stating the quantity of seed they require and requesting that they may be supplied with a copy of the form annexed."

With this Notification the following Memorandum was published :—

"*Hints on the Cultivation of Carolina Paddy.*

"*Soil, etc.*—Carolina paddy has a very strong aversion to stagnant water; therefore avoid all land on which, from imperfect drainage, water is likely to collect and stagnate. Remember that water may stagnate in the soil as well as on its surface. Select good healthy paddy-land resting on a moderately porous sub-soil and with a surface sufficiently high that it will not become a swamp during the rains while it is yet sufficiently low to admit of being watered at a moderate cost. In the endeavour to avoid a soil that is too retentive take care that you do not select one that parts too readily with its moisture, as a soil with this defect is as objectionable as one that is too retentive. Endeavour to select a soil that is neither too retentive nor too porous; in every taluq there are hundreds of acres of wet land that fulfil these conditions. These observations refer chiefly to the physical or mechanical condition of the soil. It is of much greater importance to secure a soil in a good physical condition than one in a high manural condition, as by the application of a suitable quality and quantity of manure the last-mentioned condition can so readily be secured. Land which is being put under irrigation for the first time will nearly always produce good crops of Carolina paddy.

"*Preparation of the Soil.*—The soil may be ploughed and worked in the dry state for sowing, or it may be ploughed under water and puddled for sowing. I much prefer the former arrangement; the latter is sometimes attended with advantages, but the evils which result from the wretched state in which the soil is left by the process are frequently of a very serious kind. But, whatever plan you adopt, take care to give the soil a liberal application of good manure during the time it is being prepared for the reception of seed.

"*Seed and Sowing.*—Choose a fresh sample of seed; it should be of a rich golden color; the sample should be uniform both as regards color and the size of the grain; if the seed is mixed with the seed of country paddy (which is the case almost invariably with all country-grown samples), and you cannot get a pure sample, you may, by

using a fan and a bamboo sieve, remove the greater portion of the indigenous grain. Before you finally select the seed you should test its vitality. You may do so in the following way :—

"Take a shallow vessel—a soup-plate will answer admirably; place about one inch deep of good garden soil in the plate, and scatter over the soil 100 paddy seeds; cover this with a piece of muslin, and over the muslin place about half an inch of soil. Keep the soil damp. After a few days the muslin with the upper soil may be lifted off and the condition of the seed ascertained. The number of seeds that have germinated will give the percentage of vital seeds. But you had better make duplicate experiments and take the average of the results obtained as the percentage of vital grain; ascertained in this way the results of the test are more trustworthy.

"Having selected suitable seed, and having prepared your land for its reception, you may proceed with the sowing. You may sow the seed at once on the land, or you may sow it in seed-beds and afterwards transplant the seedlings into the field. If you adopt the former of these arrangements, you may sow say, at the rate of fifteen measures per acre on either dry or puddled soil; if on dry soil, you may take the seed in its natural state and broadcast, or drill it in the soil; but, if you prefer to sow on a puddled surface, you may sprout the seed before you sow it. When transplanting is preferred, take care that the nursery-bed is *deeply* dug and thoroughly manured. When this is done the roots of the seedlings are small and compact, and the plants can be raised with ease and without suffering any injury in the operation. To produce seedlings for transplanting, sow eight measures, or about 18 lbs. of seed in the nursery-beds, for each acre of land to be planted; less will probably suffice, but this quantity will provide against any loss of plant. The seedlings may be lifted for transplanting when three or four weeks old: they may be planted in the field in the puddled, or wet soil, at distances of from six to nine inches apart, a couple of seedlings being planted together. It may be good practice either to sow the seed at once in the field, or to sow it first in the nursery, and afterwards to plant out the seedlings in the field. Thus, when the area to be sown is large, the season late, labor scarce, and seed plentiful and cheap, we would adopt the former plan, and the latter, when seed is scarce and dear, the area to be cropped small, the weather favorable, and labor plentiful.

* "*Irrigating.*—In whatever way the land is sown or planted, it should be moderately watered on the same day; this fixes the roots of the seedlings and enables the seed to meet with a good bed. It is seldom necessary to flood the land, especially after the plants begin to shade the soil. The endeavour should be to keep the land constantly damp, and not alternately in a state of puddle and dry and filled with large cracks, as is too commonly the case with wet land under ordinary paddy.

† "*After-cultivations.*—These are of a very simple nature; it is only necessary to keep the crop free of weeds and to thin out a few of the plants if the crop grows too luxuriantly.

"(Signed) W. R. ROBERTSON, M.R.A.C.,
5th September 1873. *Superintendent of Government Farms.*

"*N.B.*—The foregoing are intended only to be suggestive. Each cultivator may adopt whatever plan of cultivation he prefers."

Seed was not available for use of intending Competitors.

50. Unfortunately, the seed required to enable intending Competitors in the area of country in question, to undertake experiments, was not available; hence only a few experiments were made. It is much to be desired that the scheme should have another trial, for a year, or more, when a sufficient amount of seed is available.

General Conclusions.

51. On the whole, a fair amount of success has attended these experiments. The failures are, in many instances, to be attributed to ordinary causes under control in average seasons, and to mismanagement, or, wilful neglect.

* The practice suggested here is based on experience obtained in the neighbourhood of Madras where the evaporation is great. In districts where the evaporation is less, and where the soil is moderately retentive, the American irrigation practice might be substituted.

† Hoeing is very beneficial and should be performed.

52. There can be no doubt but that, the seed was too widely and too indiscriminately distributed. Too much was attempted; it would have been much better in every way, to have had half a dozen well-managed experiments in each District, instead of, a score or more managed as too many were.

53. Excepting, in the records of the latter experiments, the minute history of the crops has been but seldom noticed, and of such experiments it is of course impossible to form any definite opinion, as to the causes of the successes, or, failures.

54. Too little importance has been attached to the labor, trouble, and inconvenience that attends the carrying out of a field experiment. Until this, is fully recognized and, something is done to compensate the Cultivator who, undertakes such experiments, there is but little hope that they will become popular amongst our cultivating classes.

55. When our experiments are undertaken unwillingly, it is highly improbable that any satisfactory result will be obtained; it is always so easy to cause the failure of a crop and, the failure, at once puts an end to all trouble in the matter.

56. It should be borne in mind that these experimental plots, were frequently sown out of the usual sowing season, and that, therefore, if the crops did mature, they would be ready for the sickle when but few other crops were ripe, and would therefore constitute the feeding grounds of birds, squirrels, rats, insects, &c., which, in the ordinary harvest season, would have a greatly more extended feeding area, and therefore, would be less severe in their depredations on individual crops.

57. It has been proved, that the Carolina paddy reaches maturity as early as any other species of paddy grown in this Presidency; and that, the quality of its grain is, at the least, as good as that of any other variety grown.

58. Taking the whole of the results obtained, there was an amount of discordancy impossible to reduce to anything like harmony yet, by weeding out freely all those which are admittedly failures, from floods, trespassing cattle, depredation of hares, insects, &c., or by a deficiency in the water-supply, &c., results, which are clearly inaccurately recorded, and, these of experiments conducted on too insignificant a scale, we secure something like harmony; at any rate such harmony as only could be reasonably expected in experiments conducted under such varying circumstances and over such a vast area of country. This evidence, shows, decisively, that the Carolina paddy is well suited for cultivation in this Presidency; but that, it needs better treatment at the hands of the Cultivator than that to which country paddy is usually subjected.

59. The yield obtained was, in many cases, very satisfactory, but the number-of-fold standard, adopted so frequently in the reports, is no test at all, of the producing powers of the plant, when raised under different condition but, is rather a test of the physical and chemical condition of the soil, upon which the plants were grown. The fallacy of judging of the qualities of the Carolina paddy plant, from the relation the yield bore to the seed sown, is recognized, at once, when the fact is known that, in one field, from the same seed, a return of 30-fold, and of 120-fold were obtained.

60. The Carolina paddy plant, apparently, has the power of adapting itself to very varying circumstances. Though, there is a wide difference between the climate of this Presidency and, that of South Carolina, the difference between the climates* of the *cropping seasons* of the two countries is not considerable. The period of growth and maturation of a crop depends greatly upon the total amount of heat it receives, and, this total amount, does not differ greatly, within a certain range of climate, for where the temperature is lower, the crop takes a few days longer in reaching maturity than where a higher temperature prevails, other conditions being equal. Thus, the amount of heat needed to mature a crop of paddy is, approximately the same, whether the mean temperature of the District in which it is grown is 70 degrees, or 80 degrees. The number of days, the crop is in reaching maturity multiplied, by the mean temperature, of each month, will give the heat required by the crop, as shown below :—

* Of course, we need to know more than the mere average temperature of a locality in order to determine whether the climate of that locality is fitted for certain crops.

SOUTH CAROLINA.

Average date of sowing—15th of April.
Do. of reaping—15th of September.

—	Average Mean Temperature of the Month.	Total.
April, 15 days ..	57·0	855·0
May, 31 do. ..	69·8	2163·8
June, 30 do. ..	74·1	2223·0
July, 31 do. ..	79·4	2461·4
August, 31 do. ..	76·2	2362·2
September, 15 do. ..	73·1	1096·5
		11,161·9

KISTNA DISTRICT.

Average date of sowing—1st of August.
Do. of reaping—15th of December.

—	Average Mean Temperature of the Month.	Total.
August, 31 days ..	83·4	2,585·4
September, 30 do. ..	82·2	2,466·0
October, 31 do. ..	80·4	2,492·4
November, 30 do. ..	77·3	2,319·0
December, 15 do. ..	74·7	1,120·5
	..	10,983·3

MADURA DISTRICT.

Average date of sowing—1st of October.
Do. of reaping—15th of February.

—	Average Mean Temperature of the Month.	Total.
October, 31 days ..	80·0	2,480·0
November, 30 do. ..	78·3	2,349·0
December, 31 do. ..	76·5	2,371·5
January, 31 do. ..	76·3	2,365·3
February, 15 do. ..	78·4	1,176·0
	..	10,741·8

COIMBATORE DISTRICT.

Average date of sowing—15th of August.
Do. of reaping—31st of December.

—	Average Mean Temperature of the Month.	Total.
August, 16 days ..	76·9	1,230·4
September, 30 do. ..	77·1	2,313·0
October, 31 do. ..	76·3	2,365·3
November, 30 do. ..	75·4	2,262·0
December, 31 do. ..	73·6	2,281·6
	..	10,452·3

MADRAS DISTRICT.

Average date of sowing—16th of October.
Do. of reaping—28th of February.

—	Average Mean Temperature of the Month.	Total.
October, 15 days ..	77·8	1,167·0
November, 30 do. ..	77·7	2,331·0
December, 31 do. ..	79·8	2,473·8
January, 31 do. ..	74·9	2,321·9
February, 28 do. ..	77·0	2,156·0
	..	10,449·7

KURNOOL DISTRICT.

Average date of sowing—15th of August.
Do. of reaping—31st of December.

—	Average Mean Temperature of the Month.	Total.
August, 16 days ..	81·2	1,299·2
September, 30 do. ..	79·6	2,388·0
October, 31 do. ..	79·3	2,458·3
November, 30 do. ..	76·4	2,292·0
December, 31 do. ..	74·5	2,309·5
	..	10,747·0

Two cultivating seasons in Madras.

The foregoing illustrations, are not so representative as could be desired. But the necessary meteorological data was not available for all the Districts. We have, in different parts of this Presidency two distinct seasons for sowing paddy; that is, the season which is inaugurated by the advent of the South-west monsoon and, that which begins with the appearance of the North-east monsoon; the temperature of the two seasons calculated as above differs but little. There is but a slight difference between the amount of heat required to mature a crop of paddy in this Presidency and in South Carolina, thus;—

Districts.	Amount of Heat needed to mature a Crop of Carolina Paddy.
	Degrees.
Kistna	10,983
Madura	10,741
Coimbatore	10,452
Madras	10,449
Kurnool	10,747
South Carolina ..	11,161

The dates of sowing and reaping, given in the foregoing tables, are only approximately correct for, there is considerable diversity in the dates given in the returns of each District, due possibly, to the crops being cut at different stages of maturity. However, the dates are as correct, as the information available permits.

61. It may be assumed that, in all parts of this Presidency Carolina paddy matures in $4\frac{1}{2}$ months, that is, will be fit for cutting, though the straw may not be ripe, in $4\frac{1}{2}$ months from the date of sowing. In America, it is clearly established, that the

crop needs five months to reach maturity, and the American Planter always cuts the crop immediately the grain is hard, a much earlier stage than at which, in this country, it is usual to harvest paddy.

62. It has been proved that plants usually need each a particular climate; a temperature, which is favorable to one, is hurtful to another and, fatal to a third; hence, there are limits to the migration of species of plants; but some plants have a greater power of adapting themselves to new conditions than others. The paddy plant appears to have the power of modifying its habits to very varying conditions; hence, its introduction and acclimatization in so many countries; the barriers, opposed to its spread, appear to be chiefly those connected with temperature; as has been shown there are good grounds for believing that, there are no such barriers to prevent the spread of the Carolina plant to all the paddy-producing areas of this Presidency.

No climatical barrier to prevent extension of Carolina paddy cultivation over the Plains of this Presidency.

63. Experience, in attempting the naturalizing of other plants, has shown that even when the climate has been favorable, the newly-introduced plants are at first never so robust and vigorous as similar plants are in the country from which the introduction was made or, as such plants become after being thoroughly established in their new home. While undergoing naturalization, plants suffer much more severely, than they afterwards do, from irregularities in culture, or, weather. When the rice crop failed in Italy, in 1829, fresh seed was obtained from Carolina but, it was many years before the new variety of paddy adapted itself to the soil and climate. There can be no doubt, but that much greater and more continued efforts, than have yet been made, are requisite to secure the naturalization of Carolina paddy in this Presidency.

64. In dealing with the Ryots, few persons appreciate the difficulties that have to be overcome, in introducing a new crop. On this subject, the following extract is well worth attention; it is from Sir Henry S. Maine's recent work, "Village Communities," at page 103;—"Of late years it (the British Government) has done its utmost to extend and improve the cultivation of one great staple, cotton, amid difficulties which seemed to be very imperfectly understood by those who suppose that in order to obtain the sowing of a new crop in a new way, from a peasant in bondage, to hereditary custom, it is enough to prove to him that it is very likely to be profitable." All who have made any attempts in this country in this direction, will agree with Sir Henry Maine, that much more requires to be done to induce the Ryot to cultivate a new crop or, adopt some other system of culture, than merely to prove that profit will result therefrom.

Superstition and ignorance prevent progress.

65. If, as there is every reason to believe, the Carolina paddy originated from seed imported into America from Madagascar, it would be better in many respects to go to Madagascar for fresh seed for India rather than to America. In the Appendix will be found a letter referring to the rice of Madagascar.

66. But, even if every success was to attend the efforts to produce in this country a sample of paddy equal, in every respect, to that grown in South Carolina, there would yet remain a great deal to be done, before the rice prepared from it could successfully compete in Europe, with the Carolina rice of America. The high price of Carolina rice is due, to a considerable extent, to the very complete preparation it undergoes for the market.

Great improvement would be necessary in the preparation of rice.

(Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

NOTES ON CAROLINA PADDY IN AMERICA.

1. When engaged in drawing up the foregoing Report I had frequent occasion to inquire regarding the habits, and mode of culture, of the Carolina paddy plant, in America. In my search, for information, I found it necessary to consult many American Publications almost unknown in this country, or in England. I consulted, with much benefit, a number of the Agricultural Newspapers of the Southern States, and, the Annual Reports of the Commissioner for Agriculture who, very kindly, furnished me with a number. I have put together much of the information thus collected, in the hope, that it will be of use to future Experimenters with Carolina paddy:—

History and Peculiarities of the Crop.

2. There is much uncertainty, as to the time when paddy was first introduced into the United States and, as regards the country from which the first seed was obtained.

When first introduced.

The most reliable accounts show that the crop was first grown some time about the middle of the 17th century. It is asserted by some authorities that the first crop raised was produced from East Indian seed while, other authorities assert equally as positively that Madagascar seed produced the first crop. Seed from India and Madagascar certainly appears to have been introduced; and, the evidence tends to show that the Madagascar seed was introduced some time after that obtained from East India. As it is highly probable that Madagascar received the paddy crop from India, the Carolina paddy of America, may, after all, be descended from Indian paddy.

3. Madagascar possesses a variety of paddy which resembles in many respects Carolina paddy. It is known in Madagascar as Rojofotsy. The grain is larger than that of ordinary Carolina paddy and, the rice obtained from it is nearly as white. It is possible that this paddy, may have been the variety introduced into America from which the Carolina paddy has descended. The color of the husk, is certainly not that golden color which characterizes the Carolina paddy but, it is quite possible that the color may have become gradually darker from the conditions the plant has met with in its new home.

4. The first seed appears to have been a white-chaff variety, similar in general appearance to that usually grown in America on uplands. This

White-chaff grain.

white-chaff grain for many years was, apparently, the only variety of paddy grown.

5. The gold-seeded grain, so called from its rich golden color, is now, the ordinary Carolina paddy of commerce. It was brought into

Gold-seeded grain.

notice some time before the Revolutionary War. From its superior quality its cultivation rapidly spread over all the paddy-producing regions. Its origin, is unknown, some say that it is descended from Madagascar seed which, they say, possessed qualities similar to those which distinguish this variety of paddy, but others, assert that its qualities are altogether of a superior grade to those possessed by the imported paddy, whether from India or Madagascar, and they, attribute its present excellences to *careful culture on good soils.*

6. There are two well-distinguished varieties of gold-seed paddy, the long-grain, and, the variety noticed in the previous paragraph. The long-grain is a very valuable variety, but its cultivation is on a very limited scale, from superior soils and high cultivation being necessary for its successful culture. This variety is supposed to

have been established by the careful culture, during a series of years, of the seed descended from an unusually fine ear with long grain, accidentally discovered in a crop of the ordinary variety. The rice of the long grain commands a higher price than the best qualities of the ordinary rice, but there is only a limited demand for it.

7. There are now several varieties of paddy cultivated in America; most of them are aquatic in their habits. Some, from long usage, have become suited for upland or dry tillage. It is universally admitted, that all the finest varieties need *particular care* during cultivation.

Land usually cropped with Paddy, and method of preparing it for cropping.

8. The land that has usually been found best adapted for paddy, is generally situated on the banks of tidal rivers. Such land is usually alluvial. As *thorough drainage* is deemed as essential as, a command of irrigation water, for the successful culture of the paddy crop, efforts are usually made to secure a site for a plantation where the tide, in the adjacent river, has a rise and fall of not less than 3 feet, generally, from 6 to 8 feet is considered preferable. As, salt water is so pernicious to the crop, paddy culture is generally confined to land situated above the place where the salt and fresh water meet in the river. From the rise and fall of the tides the irrigation and drainage of the land are almost under perfect control.

Thorough drainage as essential as irrigation.

9. Adjacent to all the great rivers, in the Southern States, there are vast areas of marshy alluvial land, which will probably eventually be reclaimed and utilized for producing paddy, recent experience having shown, that with the aid of steam pumps and suitable engineering arrangements, such land can be reclaimed and cultivated with profit. As yet, the crop is confined chiefly to land on which the natural irrigation and drainage facilities before mentioned can be secured.

10. The production of paddy, received such a very serious check during the late war, that the Americans were compelled at one time to become large importers of rice. During the last year or two however, there has been a very large increase in the area cropped with paddy, and the production of rice is now almost as great as ever. It is worthy of note that, a large tract of country formerly under rice plantations is now lying abandoned, from the soil having become too sour to yield a healthy, crop, the result of the neglect of drainage during and immediately after the war.

Soil injured by neglect of drainage.

11. In-land swamps, that are capable of being drained, are also, when irrigation water is available, used for growing paddy, but the profits attending such cultivation are never so great, as those obtained from the cultivation of the river-side land.

12. When these river-side swamps are being reclaimed, the first step is to protect them from being flooded by the adjacent river, this is effected by raising large embankments not only along the river boundary of the land but, around the whole of it, where there is a probability of flood-water flowing. The land that is to form the plantation, is next divided by smaller embankments into fields of from 10 to 20 acres in extent, skirting each of these banks, on the inner side, are open drains, of about 4 feet in depth, which communicate with the large main drain or channel, afterwards to be noticed. A flood-gate, or sluice, is provided for each of these fields, so that each can be watered, or drained, as circumstances demand. These fields, are again sub-divided by open ditches communicating with the side drains; thus, the field is cut up into beds of from 20 to 30 feet in width, each of which is made as level as possible. The main drain, or channel, is generally cut through the centre of the plantation; it is about from 4 to 5 feet in depth and from 20 to 30 feet in width. This channel, or drain, is used for introducing the irrigation water at high tide, and for draining off water at low tide being in connection with the adjacent river, sluices or flood-gates being provided at its junction with the river for the entrance, or escape, of the water. The channel is also used for navigation purposes for the large flat-bottomed harvest boats used on the plantations.

Reclamation of land for Paddy Culture.

Cultivation of the Crop.

13. In preparing paddy land for a crop, if the soil is known, or suspected, to be infested with an inferior kind of paddy known to the planters as volunteer paddy, it is usual first to plough to a moderate depth and to water lightly, at intervals during one or two months. This is done to cause the seed, that may be in the soil, to germinate and produce plants, the plants being afterwards killed by being ploughed down. This volunteer paddy is a most troublesome pest on the paddy plantations in America. When growing, it cannot be detected from the plants of the crop. It comes into ear sooner than any other variety of paddy, and as it sheds its grains immediately they begin to ripen, it is exceedingly difficult to avoid having the land seeded again.

Method of destroying Volunteer Paddy.

14. The first ploughing, in preparing the soil for the crop, is usually performed some time in December. Occasionally, a light covering of water is run over the newly-ploughed land in view to the furrow slice becoming thoroughly frozen, experience having shown that the pulverization produced by the thawing of the frozen soil, is much more perfect than that done by tillage implements. About the end of March, a harrow or a cultivator is passed over the furrow slices, or such portions of them as the frost has not fully acted on. The next operation is, usually, to raise the soil in ridges, which is done by means of large hoes; the ridges are, generally, from 12 to 15 inches apart, that is, from centre to centre. Occasionally, the land is dug over by means of hoes, instead of it being ploughed. Some planters consider digging in this way preferable to ploughing but, of late the practice has gradually fallen into disuse from the great increase in the price of labor in the Southern States.

15. Until recently, manure was very seldom used in paddy cultivation, the silt brought down by the rivers being considered a sufficient manuring; but now, it is largely applied on all the best-managed plantations. The use of manure necessitates much greater care in applying the irrigation water but, when a sufficiency of manure is used, a less quantity of water suffices. The husks, which are rich in mineral matters, the straw of paddy, the mill dust and other refuse of rice-mills, are largely used for manuring paddy land. A considerable quantity of the meal of the cotton seed, is also used for the same purpose. When manure is applied, it is usual to spread it over the land previous to the first ploughing and to plough it in. Occasionally, when the character of the manure admits of this, it is broadcasted over the ground as a top-dressing and is hoed into the soil. It has everywhere been found that manure, when selected and applied with judgment, produces a very marked improvement in the yield and in the quality of the grain.

Manure found to be necessary.

16. The seed is sown in different ways, sometimes, it is broadcasted and, at other times, it is drilled over the levelled surface of the ground, but usually it is sown in the furrows between the ridges before described. The quantity of seed sown, varies from 1 to 2 bushels, per acre. The weight of the seed varies from 44 to 45 lbs. per bushel. Sowing usually takes place in the first or second week in April. Great trouble is taken to secure a frequent change of seed, as it has been found that the grain deteriorates when produced year after year from the same seed. It does not appear to be the practice anywhere in the rice districts of the United States, to raise seedlings in nursery beds for transplanting into the field, as is the custom of treating indigenous paddy, in so many parts of the Madras Presidency.

Frequent change of seed necessary.

17. There is a great diversity in the irrigation practice of the rice planters of the Southern States. Usually, it is the practice to irrigate the land immediately after it is sown and to keep it under water for 4 or 5 days or until the grain has sprouted after which, the water is withdrawn, if not absorbed by the ground. This irrigation is technically termed the "sprout flow." During the following month, the land is left dry, or only slightly moistened, weeding being done when necessary. In the fifth week, irrigation water is again applied, and it is kept on the land, to within an inch or two of the top

Management of the irrigation water.

of the seedling plants, for a fortnight, the water being changed whenever necessary; this irrigation is called the "stretch flow," because of the tendency it has to lengthen the blades of the young seedlings. This watering is very beneficial in killing down any grass which may have appeared in the crop. At the end of the fortnight in question, the water is drained off, and the land remains dry for about from 4 to 5 weeks, at the expiration of which time the plants usually begin to throw up their ear sheaths. During this long period of "dry culture" the land is thoroughly hoed and cleaned. The third irrigation called the "harvest flow" is next applied and the land is kept under water, until a few days before the harvest commences, the water being frequently changed, in the interval.

18. Another practice is, to water the newly-sown land for 4 or 5 days and then to leave it dry until the seedlings are about 4 inches in height. After the plants have reached this stage, the irrigation water is again admitted over the ground for a period of a fortnight, after the expiration of which time the water is withdrawn and the land is left dry for 6 weeks, being frequently hoed in the interval. At the end of the 6 weeks, the plants being then about 14 weeks old, water is again admitted over the ground and as in the practices already described, it is kept on the land with frequent changes until the crop is ready for cutting. There are several other minor differences in the management of the irrigation water; the great aim is, to keep down the weeds, and to preserve the land in a healthy state; lengthened floodings, being intended to kill down the grass, quick drainage to cleanse the surface of the land; and, frequent dryings to restore the capillary action of the soil, to afford facilities for its culture and weeding.

19. The flowering season of the rice plant is usually in August. Should the weather be stormy in this month the anxieties of the rice planter are very great, for, stormy weather in the flowering season reduces the yield of the crop very seriously.

Harvesting.

20. The crop is usually ready for harvest about 5 months after the date of sowing; September is thus the usual harvest month. The crop is cut before being quite ripe; usually, when the lower grains are hard; it is cut by means of the sickle or the reaping-machine but, generally, by the former. It is usual to tie the crop in sheaves which are stooked in the field for a few days. When ready for stacking, the crop is boated to the stack-yard. Great care is taken in stacking, lest there should be too much heat in the stack and the grain become discolored; a little heat is considered rather an advantage, as it gives the grain a rich yellow appearance. Threshing is performed by ordinary threshing machines driven by steam. Some of these machines are very large and are capable of threshing as much as 1,000 bushels of grain per day.

The yield.

21. The yield, is generally from 40 to 60 bushels of grain per acre, weighing about 45 lbs. per bushel. The straw is usually from 4 to 5 feet in length and from 2 to 3 tons, per acre, and is much valued for feeding stock.

Preparation for the Market.

22. The paddy is husked in different ways, sometimes by ordinary horizontal mill-stones and by large iron-shod pestles working in wooden mortars. Usually, the paddy is subjected to both the mill and the mortar processes in undergoing conversion into rice, the outer husk being removed by the mill and the inner cuticle by the mortar. After leaving the mill, or mortar, the broken rice, husks, dust, &c., are separated from the rice which is then sized and polished under an elaborate arrangement; the market-value of the produce depends very greatly upon the skill with which the rice has been treat while undergoing these finishing processes. The following extract will afford some idea of the intricacy of the processes, by which paddy is converted into rice in America;—

"The rough rice is first ground between very heavy stones, running at a high speed, which partially removes the rough integument, or half chaff. This chaff is passed out of the building by spouts, and the grain by similar means conveyed into the mortars; where it is beat or pounded for a certain length of time by the alternate rising and falling of very heavy pestles shod with iron. These are operated by a revolving cylinder of huge dimensions, armed with powerful levers, which, passing into a long opening in the pestle, about 15 feet in length, raise it in mid air and let it fall suddenly into the great mortars below. From the mortars, elevators take the rice to the fans which separate the grain from the debris. From thence it goes through other fans that divide it into three qualities known as "whole," "middling," and "small rice." The grain is lastly passed through a polishing screen, lined with gauge wire and sheep-skins, which revolving vertically at the greatest possible velocity embellishes it with that pearly whiteness in which it appears in commerce.

"From the screen it falls immediately below into a tierce, which is kept slowly rotating, and struck on two sides with heavy hammers, all the time it is being filled, for the purpose of obtaining its greatest capacity. The tierce, as soon as full, is removed and coopered ready for market. The cost of such a mill was $1,000 per pestle —50 pestles being considered a good market mill."

23. The planter, sometimes decorticates the paddy and sends the clean rice into the market, but usually, the process is performed in large mills owned by persons exclusively engaged in the trade. The husking and finishing processes are also performed for hire, but, more frequently the mill-owner purchases the paddy. In New Orleans one cent. per pound is charged for husking and polishing rice of the first quality; for lower qualities the charge is usually about half a cent. for each pound of rice cleaned. A bushel of paddy of 45 lbs. will yield about 29 lbs. of clean rice.

Before the material for the foregoing notes was all collected, I had applied to Dr. Forbes Watson, M.A., M.D., &c., Director of the India Museum, who had procured the Carolina paddy seed used in the Madras experiments, for any information he could give, regarding the peculiarities of the culture of Carolina paddy in the Southern States of America. He was good enough to communicate with some Correspondents residing in the rice-producing regions of the Southern States, and has been able, to place at my disposal the following very valuable extracts, from a letter received in reply. The information afforded is very clear and practical, and though much the same ground is gone over as in "the Notes" just given, it seems highly desirable that "the extracts" should appear here in full, because the facts they give corroborate the information collected from other sources, and they afford information which has not hitherto been at the disposal of those engaged in naturalizing the Carolina paddy plant in this country. These "extracts," are from a letter, dated South Carolina, 28th of January 1876, and are as follows:—

"There are only two varieties of rice at present generally cultivated, namely, the Gold and the White; of these the Gold is much the most extensively used, probably in the proportion of more than 6 to 1, the white rice laboring under the disadvantage of shedding more readily when ripe and consequently in case of a wet harvest the waste is much greater than with the other. There is also a variety of white seed known as bearded rice somewhat resembling wheat, but it is not used by the Coast planters as the sample is inferior. The red rice is what is commonly called

Volunteer, from the fact that it puts in an appearance when it is not wanted, or in other words, it seeds itself from year to year. It is caused by the shedding of rice during the harvest and after being exposed to the action of the air and Winter rains it is ploughed in and germinates with the new crop, ripening a few days in advance, it drops its seed upon the ground whence it springs up again with the following crop. In each successive year it acquires a darker red color and the land eventually becomes so polluted with it that a change of culture is necessary to eradicate it. The peculiarity of the Volunteer is that it is impossible to harvest it in any quantity, for it sheds its seeds as it ripens, and when it is abundant, being the stronger plant, it chokes out the crop rice. Fields have been known where at least fifty bushels of rice have been matured to the acre, to yield the planter less than twenty on account of the shedding of the Volunteers.

"It is the great curse of the planter and is more dreaded than grass as it is not to be distinguished from the crop rice until harvest time. The hull of this rice is generally white and there is more or less of it in all seed, it being impossible to procure seed perfectly free in any quantity.

"The value of seed depends in a great measure upon the percentage of Volunteer, that having the least quantity being of course the most valuable. The size of the grain depends upon the culture of the fields. There is no upland culture of rice of any consequence. Many of the upland planters however sow a few acres of swampy or wet land in rice for home consumption, but the amount sent to market is inconsiderable and of very inferior quality. There is a tradition that the first rice seed was sent from England to a gentleman of Charleston enclosed in an envelope and was by him cultivated in his garden the seed produced being distributed among his friends, at first it was cultivated by draining ponds and marshy land but after two or three years it was found that grass took possession of the land *on account of the want of drainage* and it had to be abandoned afterwards large backwater reservoirs were formed and the low lands lying in front were ditched and drained; this improved the sample of the grain and some few of the best of these places are still in use. It was then found that the marshes lying near the mouth of large fresh water rivers, *where the rise and fall, or pitch, of the tides were sufficient for purposes of irrigation and drainage*, were best suited to the culture of rice, the lands were reclaimed by banking, and that portion lying immediately on the river was divided into squares, or fields, varying in size from twelve to forty acres, according to the level of the ground. Creek bottoms were filled up and the high portions taken off to bring the land in each square as nearly on a level as possible, in these squares trunks were placed with shutters on both sides, to serve for either irrigation or drainage, the level of the trunk being low water mark which, was found on this river to give a *drainage of five feet* and the rise of spring tides being seven feet four inches enabled the planter to flow his lands to a depth of two feet if he desired it, each of these squares was surrounded by a bank, and a ditch five feet in depth and about the same in width was cut entirely around the square, this ditch is called a face ditch; the square was then divided into beds of fifty feet in width between which were cut what are called quarterdiars three feet deep and about eighteen inches wide, running from face ditch to face ditch, each field being surrounded by banks could be flowed independently of the other squares and the trunk enabled the planter to hold the water at any required level.

"The amount of land contiguous to the river being insufficient and the extent of tide lands limited, it was found necessary to clear the swamps further back, lying at the same level as the river lands, this was effected by cutting canals connected with the river by flood gates, which when opened on the rising tide would furnish sufficient water to irrigate the amount of land required, squares were laid out on each side of the canal in the manner described before, every square having its own trunk which enabled the planter to flow it while keeping any other parts of the plantation dry, some places run back from three to four miles through this system of canals. It was found that *the thorough drainage* and ability to flow at the option of the planter enabled him to keep down the grass, the great enemy of the growing crop and to depend with nearly absolute certainty upon the product, the water-supply being

unlimited and no loss has ever been sustained except from September gales, which do not occur sufficiently violent to cause a total loss more than once in fifty years.

"The lands themselves are inexhaustible and *the deposit from the river water with which they are irrigated possesses great fertilizing properties.* It is improbable, however, that these lands would ever have been reclaimed from the river without slave labor as the task would have been too expensive and too onerous for white labor besides the liability to malarial fevers and it is doubtful whether the freed man could ever have been induced to undertake it.

"Rice is planted from March to June the ditches having been cleared and the lands ploughed and harrowed, it is sown in trenches or drills fifteen inches apart and from two to three bushels of seed are used to the acre according to the fancy of the planter.

"After being sown and covered, the fields are flooded until the rice has sprouted, the time of which will vary with the weather from three to ten days.

"This flow which is called the sprout water, is then drawn off and the land kept dry until the seed has rooted and the plant made its appearance above ground, as soon as the rice can be seen for some distance in the trenches or rows, the second water which is called the stretch flow, is put on and held very deep for three or four days until the blade of the rice is stretched from four to six inches, it is then slacked off and held very shallow from twenty to thirty days, by which time the rice has become hardy and attained a vigorous growth, after which the squares are again dried and the hoes put in to break up the alleys between the rows and eradicate the grass; the rice now gets what is called the dry growth and is kept perfectly dry for a month or six weeks during which it is worked one, two, or three times, and all weeds and grass carefully picked out, on these workings the crop in a great measure depends, as soon as the stalk joints the lands are again flooded, and the water is held until the grain ripens, this is called the harvest flow, and is held about two months, when the water is drawn off; the rice is ready for the sickle and is cut and stacked in the fields, until it is brought to the thresher which is done by means of flats in the canals above mentioned. The quality and size of grain, depends upon the care exercised in the preparation and culture of the land, but more particularly upon *thorough drainage* which enables the plant to put out *deep roots* and to become strong and hardy during the dry growth, this necessitates great expense in cleansing all the ditches every year, and in keeping the trunks and floodgates in repair. After the late war the plantations having been abandoned, devastated by the enemy, the ditches had become filled up and consequently the land was sour, and it was several years before the planters could produce as good a sample as had been made previously, but by close cultivation the quality of the grain has improved year by year until now it is fully equal to any produced before the war."

(Signed) WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

29*th September* 1877.

CORRESPONDENCE, FINANCES, ESTABLISHMENT, &c.

Increase in the correspondence of the Department.

Correspondence, &c.—The correspondence of the Department continues to increase; as this increase is due chiefly to more frequent communications with persons engaged in the management of land, it affords grounds for satisfaction. Advice has been sought on many subjects connected with agricultural improvement, and we, have been favored with useful information by several correspondents. The following, are some of the subjects on which advice, or information, was given in the past year;—

Subjects.	District from which the applications came.
Manural uses of Animal Charcoal	Madras.
Lime as a manure on Coffee land	Mysore.
Cotton culture	Coorg.
The cultivation of Sorghum	Salem.
Fodder crops	Trichinopoly.
The choice of Implements and Tools for a Zemindary Farm	Tinnevelly.
Coffee cultivation, Soils, Climate, &c.	Bellary.
The culture of "the Planter's Friend"	Travancore.
Cholum, as a fodder-crop, and the merits of other indigenous fodder-crops.	Central Provinces.
Proposed purchase of a Threshing machine and a Reaping machine	Tanjore.
Feeding Horses on Guinea-grass fodder	Madras.
The culture and curing of Tobacco	Pondicherry.
The value of Slaughter-house refuse as manure; and, the means by which it could be converted into a portable manure.	Madras.
Cultivation of Guinea grass	Travancore.
Wheat cultivation	Chingleput.
The treatment of a stiff black soil, difficult to prepare for a crop	Cuddapah.
Cultivation of Sorghum	North Arcot.
Culture and treatment of Corakāpilly hedges	North-West Provinces.
The "Double Mhote" as a water-lift for general use	Mysore.
Preparation of Gram for horses	Madras.
The preparation of Hay from Guinea grass	Trichinopoly.
The management of Milch cattle	Madras.
The utilization of the refuse bone charcoal, of Sugar Refineries	Wynaad.
Management of Paddy land	Mysore.
Saltpetre as a manure for Coffee shrubs	Wynaad.

2. As usual, a large correspondence was conducted with the Board of Revenue. In addition to letters on the ordinary business of the Department, the Board were addressed on the following subjects:—

Grass experiment in the Nellore District.—Submitting remarks on —. Board's Proceedings, No. 1324, dated 20th May 1876.

Sorghum Saccharatum and Planter's Friend.—Suggestions regarding the distribution of the seed of —. Board's Proceedings, No. 1109, dated 26th April 1876.

District Farm, Coimbatore.—Report on a site for—at Othikkalmandapum. Board's Proceedings, No. 1175, dated 4th May 1876.

District Farm, Coimbatore.—Report on a site for—near the town of Coimbatore. Board's Proceedings, No. 1178, dated 4th May 1876.

Commissariat Slaughter-yards.—Proposals for adapting for use as cattle-yards —. Board's Proceedings, No. 1402, dated 29th May 1876.

Prickly Comfrey.—Remarks on proposals to introduce —. Board's Proceedings, Miscellaneous No. 4908, dated 13th June 1876.

Tobacco Seed.—Proposals for obtaining for distribution —. Board's Proceedings, Miscellaneous No. 5724, dated the 7th of July 1876.

Decrease of the Grass-land of the Coimbatore District.—Remarks on —. Board's Proceedings, No. 3044, dated 2nd December 1876.

Wind Engine for raising Water.—Report on —. Board's Proceedings, No. 1768, dated the 11th of July 1876.

Agricultural College.—Submitting a list of text-books to be used in —. Board's Proceedings, No. 1961, dated the 2nd of August 1876.

Distribution of Agricultural Seeds.—Proposals —. Board's Proceedings, No. 2082, dated the 16th of August 1876.

Subterranean water; Proposals to utilize—in the Tinnevelly District.—Remarks on —. Board's Proceedings, No. 2112, dated the 18th of August 1876.

Zemindary Farm proposed in Tinnevelly.—Suggestions for establishment of —. Board's Proceedings, No. 2244, dated the 1st of September 1876.

Subsoil drainage experiment.—Report on —. Board's Proceedings, No. 3081, dated the 6th of December 1876.

3. FINANCES—*Balances.*—The balance in favor of the department at the beginning of the year was Rupees 2,09,344-8-6.

Receipts.

4. The receipts in the year amounted to Rupees 96,806-12-1 against Rupees 94,933-9-6 in the previous year. These receipts were obtained from the following sources:—Surplus Pound Funds Rupees 71,707-9-6, Provincial Funds Rupees 20,000, Sydapet Experimental Farm and Workshops Rupees 5,099-2-7. The income from the Surplus Pound Funds was Rupees 4,762-9-1 greater than last year; while, the income from the Sydapet Experimental Farm and Workshops was Rupees 2,889-6-6 less than last year, due partly to the large area of land put under grass for the cattle acclimatization experiment, and to the unfavorable character of the year.

Expenditure.

5. The total expenditure of the year was Rupees 49,819-11-6 against Rupees 56,722-12-9 in the previous year. The expenditure under the different headings was as follows;—

General Supervision.—The expenditure was Rupees 19,685-15-3 against Rupees 18,672-7-8 last year.

Sydapet Experimental Farm.—The expenditure was Rupees 12,517-10-6 against Rupees 13,125-8-8 in the previous year.

Implement Workshops.—The expenditure was Rupees 1,946-8-0 against Rupees 2,359-6-8 last year. The expenditure under this heading fluctuates with the demand for implements.

Educational (Apprentice Classes).—The expenditure was Rupees 1,356-4-8 against Rupees 2,354-11-9 last year; these classes having been abolished there will be no further expenditure under this heading.

Agricultural College.—The total expenditure incurred on account of this new Institution, during the few months it has been in existence, was Rupees 5,594-13-2.

Permanent Estate Improvements.—The total expenditure under this heading was Rupees 6,373-12-10, against Rupees 9,928-6-0 last year.

Other Charges.—These consist of transfers, made in the office of the Accountant-General, to adjust claims for purchases made in England through the Secretary of State, to pay the salary of an Inspecting Veterinary Surgeon and to meet claims in other departments, &c. These charges, amounted in all to Rupees 2,344-11-1 against Rupees 10,282-4-0 last year. The smaller expenditure is due to the appointment of Inspecting Veterinary Surgeon, having been vacant during the year.

6. There remained at the end of the year a balance, to the credit of the Department, amounting to Rupees 2,56,331-9-1.

7. The usual statement of income and expenditure appears in the Appendix.

8. *Establishment.*—Mr. Benson continued to have charge of the Sydapet Experimental Farm, and Mr. Schiffmayer had charge of the extensive Estate Improvements carried out during the year. Both gentlemen have afforded me much valuable aid. Mr. Schiffmayer's services will be available for carrying on a District Farm when they are so required. The Overseers, Clerks and others have, generally, afforded satisfaction in the performance of their respective duties.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms.

29th September 1877.

THE GROWTH OF FORAGE FOR LIVE STOCK WITH SOME REMARKS ON OUR FODDER PLANTS.

Introduction.

1. The discussion of the subject of this paper is weighted with many difficulties, owing to the branch of husbandry to which it refers being totally ignored in Southern India; this being the case, it is necessary to show, first the reasons for the introduction of the industry, and then what might be done in it by the Native cultivator.

Present custom of pasturing bad.

2. To preserve the life of their cattle, it is the habit of the ryot in many districts during the hot weather to drive them great distances in search of pasture; when he finds this pasture, probably on the slopes of some hills, in jungles and wastes, it is of a poor character, coarse, innutritious and indigestible; during the time that the stock are being depastured in this manner they are subjected to the ravages of beasts of prey, and the effects of exposure, and all their excretions are wasted as manure. The effects of this innutritious feeding are evident in the diminutive ill-formed cattle to be seen generally throughout the country.

Great value of Live Stock.

3. It is generally acknowledged, I believe, that the presence of an abundance of good agricultural stock in a country denotes agricultural wealth, and *vice versa*, and that, amongst this stock, live stock in the shape of cattle and sheep is the most important; even in Japan and China, which countries are commonly quoted as exceptions to the rule that live stock are highly valued agriculturally, it appears, from the reports of recent travellers, that the value set on them is great. The cultivating power there is in many respects very similar to that of this country; for the supposition that the cultivation is nearly all spade-culture, a system which is not to be found in this Presidency to more than a minimum extent, has been proved to be incorrect regarding the interior districts. The consumption of meat for human food in this country is considerable and in reality greater than is usually supposed.

Fodder raising profitable.

4. In Europe, America, Australia, and elsewhere, the growth of food for live stock is recognised as a most remunerative branch of husbandry. It has been proved by experience, that it is more economical to bring the food of an animal, which is either performing labor or being fattened, to it, than to let it wander in search of the means of existence. It is known, that the excreta of animals are a most valuable source of plant food, and that to collect them (their waste being a suicidal proceeding) it is necessary to confine stock to a limited area in order to accomplish it satisfactorily and economically. When cattle are allowed to roam at will, mixing herd with herd, the spread of contagious and infectious diseases is encouraged and facilitated as is shown by the enormous mortality so often seen amongst the live stock of Southern India from this cause. I have said that fodder raising is a remunerative branch of agriculture; the profits from it are not to be immediately counted out in rupees, but in the larger supplies of organic manures, so much required in this famine-stricken land, in the greater number, the better health, the earlier maturity, fuller development, greater power, and stronger constitutions of the live stock.

5. The old saying, that "the man, who makes two blades of grass to grow where one grew before, is a benefactor of his country," is a summary of the rationale of fodder raising. To keep two animals, or one animal equal to two of the description formerly kept, on the same area, should be the end and object of the husbandman. The economy of growing food for live stock, generally speaking, close to their homestead must be evident—not indeed for the young stock because they have no labor to perform, but especially for the draught and milch cattle of the country. If animals have their food brought to them, or can obtain it without much exertion being entailed on them, not having to exert any of their powers to carry them in search of it they are rested instead of fatigued whilst eating.

6. To improve a breed of cattle, it is an indispensable requisite that cattle, sires, dams, and offspring, should be well treated and properly fed; development depending

so much on the treatment and feeding of the animal. The necessity for the improvement of the cattle of this country is well known, and the economy of using powerful bullocks self-evident. On the roads and agriculturally, the want of good draught animals is a bar to economy of working. To the cultivator, the absence of good cattle prevents his adopting that practice essential to his well-being in this country—deep cultivation. To bring about this improvement better means of feeding cattle must be found, and they are to be found in the growth of forage crops.

Natural pasture.

7. The necessity of this branch of husbandry has been shown; to point out means easy of adoption for carrying it out must be my next endeavour. There are many ways in which forage may be raised, chief and simplest amongst them is natural pasture. Natural pasture in this country is generally very poor, the native grasses being all without exception harsh, coarse, and wiry; even the much vaunted Hurriallee (*Cynodon Dactylon*) is tough enough to remind one of hempen rope; a sward of grass is seldom, if ever, to be seen; tussocky growth is the common habit of the natural pasture, and demonstrates the want of attention which is paid to it. The improvement of pasture lands by such operations as drainage, cultivation, manuring, seeding, &c., is never practised, even if it be known. Although, in some few localities, the supplies of fodder are plentiful from natural growth, there is no general distribution of grazing grounds, and what areas, specially devoted to this purpose there are, are annually being encroached upon by the extension of the arable lands. Under these circumstances the improvement, that is causing greater productiveness of the existing lands, must, if no habit of growing fodder crops is introduced, necessarily take place, or the cattle of the country will decrease in number and size; their number at present is so small and their frame so diminutive as to suggest extinction. The growth of natural pasture without the aid of water is a matter of difficult attainment under conditions such as appertain in Southern India, although it is doubtless possible to improve the existing pastures most materially by judicious husbandry.

Improvement imperative.

8. Failing natural pasture, artificial grasses could be resorted to; but there is a great dearth of knowledge of what grasses and herbage plants could be successfully grown, and the question of the possibility of growing such has never been investigated excepting to a slight extent.

Guinea grass is a good fodder and fallow crop for a rotation.

9. One grass there is, which cultivated artificially yields good results, and it can be confidently recommended, to all who require such an one, as able to withstand the longest and most severe droughts without irrigation and spring into life with the first rain. It is the "Guinea grass," *Pannicum Jumentorium*, an exotic, but perfectly acclimatized grass, which is most easily propagated by root cuttings. Its culture is very simple, for if planted at the commencement of the rains, it soon strikes root and is then safe and out of danger for the future. If planted in rows it allows of interculture by cattle-power, by which means the land on which it grows may be easily cleaned, thus affording an excellent fallow crop; it will grow fairly on very poor lands; it cannot withstand the effects of stagnant water, but repays, although it does not require irrigation; half of the tussocks should be removed annually, and the crop should not be kept down too long, but alternated with others in rotation. No difficulty is experienced in removing it from the land so that it never appears as a weed. The fodder is produceable at the rate of Rupees 7 per ton and is of good quality.

Hurriallee grass very persistent and only useful in permanent pasture.

10. Hurriallee grass (*Cynodon Dactylon*), the Doob grass of Northern India, the Couch grass of Australia and America, is a valuable, but, I believe, overrated fodder plant, possessing great vitality and widespreading roots which are capable of propagating the grass from each section of them; it is suited to our long droughts and is also capable, under high cultivation and irrigation of producing heavy cuttings of tough wiry fodder, which however must possess considerable nutritive qualities; on poor soils it is liable to be crushed out by inferior types of plant, but on those of fair quality it is very persistent and hard to eradicate; the latter point is detrimental to its use as a crop to be taken in a rotation. The cost of producing a ton of Hurriallee grass is about Rupees 10, whilst in Madras one ton of hay which equals about three tons of green

grass may be sold for Rupees 30—40. The growth of the grass might be encouraged on waste lands by manuring and seeding, but its cultivation can scarcely be recommended except near large centres of population, where there is a demand for such forage.

Great abundance of artificial forage plants.

11. Passing from pasture, natural and artificial, I come to the next resort of the stock keeper—forage plants. If the indigenous and presently acclimatized exotic plants do not furnish an abundance of variety of pasture, it cannot be said that artificial forage crops are wanting. The ryot, who knows as little of raising special fodder crops as he does of the management of pasture, from his ignorance neglects the splendid, and unexcelled in more favored countries, sources of forage that are ready under his hand, which would enable him to produce food enough to feed far more and better stock than he has at present, and by this means to manure his lands better, thus making them capable of producing crops in seasons of drought and increasing their yield during ordinary ones.

Sugar-cane good source of fodder.

12. First, pre-eminent, stands the Sugar-cane (*saccharum officinarum*), an unrivalled producer of valuable, enticing, succulent fodder at a cheap rate. Occupying the ground about nine months only, it will produce over 100,000 lb. per acre, and not costing more than Rupees 2 per ton at the outside. Sugar-cane is an exhausting crop under the practice of growing it for external sale, but if grown as a fodder this objection to it would disappear, as the manure of the animals fed on it would contain the major portion of the valuable constituents of the soil, which it extracts during its growth. If given whole great waste would ensue with this fodder, but if chaffed the more succulent and the coarser portions becoming intimately mixed would all be consumed by stock. If the canes were used for the manufacture of sugar, the refuse, if chaffed and properly treated, could still be used for fodder.

Yellow Cholum very valuable and easily grown fodder.

13. *Sorghum vulgare*, the great millet, (Tam.) Cholum, (Tel.) Jonna, (Hind.) Jowar, stands next amongst the many plants indigenous to this country which are most economical fodder-producers. This grass is largely cultivated as a grain producer in all parts of India, the straw thus grown is used as cattle food, but the growth of it as a fodder crop, to be cut when green and succulent, is unknown to but a very small extent; cultivated well the yellow variety produces at all times of the year heavy crops of fodder; naturally, it requires irrigation, if grown during the dry season, but all the water it receives it amply repays. Producing at a single cutting often from 10,000 to 15,000 lbs. per acre, it will yield three or four cuttings and a total outturn of thirty to fifty thousand pounds at a cost of about Rupees 2 per ton. It will grow on most soils, even very poor ones, as is shown by its success on the Sydapet Farm; but, for growth to perfection at a cheap rate, stronger soils, such as those found in Bellary and Cuddapah, denominated "black cotton soils," are most suitable.

White Cholum in a great measure possesses the qualities of the yellow variety, to which it is closely allied and from which it differs chiefly in the color of the seed and the character of the panicle.

14. *Penicillaria spicata*, (Tam.) Cumboo, (Tel.) Sujjaloo, (Hind.) Bajree, is another indigenous plant, especially suited for cultivation, during a season of high temperature and light rainfall, on lands which it is not possible to irrigate. It is chiefly grown on the poorer classes of soils and does not produce very heavily. It grows well in some localities under irrigation, but does not come up to cholum either in productive powers or in the quality of the forage produced.

15. *Panicum Milliare*, (Tam.) Shamay, (Tel.) Samaloo, has been proved to produce as much as 47,000 lbs. of green fodder per acre with considerable supplies of water; the cost of production was under Rupees 2 per ton, and the fodder of fairly good quality but soft and watery. It yields two or three cuttings from one sowing.

16. *Oryza sativa*.—The country paddy may be grown profitably as a fodder crop, especially within short distances of large towns, and, in seasons of deficient rainfall, as the short supply of water, although totally inadequate for the production of a grain crop, might mature a very profitable fodder crop. Paddy will produce from fifteen to twenty thousand pounds of green fodder, or four to five thousand pounds of hay at a cost of about Rupees 2-8-0 per ton for fodder, and Rupees 7-8-0 for the hay. On the rain-fed lands, so common in Chingleput district, the growth of such a crop

would, I have no doubt, prove far more remunerative to the ryot, than the results of his endeavours to produce a crop of grain.

17. *Eleusine corocana*, (Tam.) Kelvaragoo, (Tel.) Taindulu, (Hind.) Ragi, is a fair fodder producer, but yields grain also well under moderate irrigation.

18. Horse Gram, *Dolichos uniflorus*, (Tam.) Kolloo, (Tel.) Woolavaloo, (Hind.) Koolthee, is a valuable pulse crop for forage or green manure. It produces from two to four thousand pounds of fodder in two months, at a cost of about Rupees 3 per ton and thrives with a minimum rainfall in very hot weather. The ease with which it may be cultivated recommends it most highly as a catch crop for forage purposes, either to be grazed on the land or fed in the stalls.

Deficiency of leguminous forage plants.

19. The other pulse crops of the country, are useful but not to be specially recommended for the production of fodder, and in this direction there is a want. The lack of a good leguminous plant which could be mixed with grasses in forming a pasture will be felt when that branch of husbandry is taken up; the small amount of, if any, research in the direction of improvement of pastures, &c., in this country has arisen simply from the want of good Agricultural Botanists, who would devote their time to the investigation of the comparatively uninteresting division of graminacious and other agriculturally important orders of plants. There are probably existing in other countries, grasses, legumes, and other pasture plants which might be acclimatized in this country; the study of such an extensive branch of husbandry will be a great work.

Very valuable and enticing fodder.

20. *Sorghum saccharatum.*—Of the exotic crops, which have been most successfully cultivated in this country, foremost stands the Chinese Sugar-cane, and the sub-varieties of the same plant—"Planters Friend" and "Imphee"—closely allied to our cholum, flourishing under the same conditions, it possesses several advantages over that crop; the succulence and richness in saccharine matters of the straw; the ease with which it rattoons, and the consequent possibility of raising more than one cutting from one sowing, which habit although possessed by the cholum, is more marked and perfect in this crop. The possibility of producing a crop of green fodder as well as seed is characteristic of the plant. The crop is scarcely able as yet to withstand the heats of the plains, but in the cold weather will produce from 15,000 to 20,000 pounds of straw per acre, besides 1,000 to 1,500 pounds of grain at a single cutting.

21. Maize, (*Zea mays*), (Tam.) Mukha Cholum, (Tel.) Moka Jonna, (Hind.) Mukha Jowari, is not really an exotic crop, for there are depraved varieties of it to be found growing on limited areas in various parts of the country; but, when speaking of maize, I refer more particularly to American and Australian varieties. Maize flourishes wherever cholum will grow well; requiring however a deeper soil, more organic manure and better cultivation. Grown for seed, it produces an enormous amount of nutritious grain; if cultivated for fodder, the forage produced is of very high value. In quantity it will equal the yellow cholum, but is rather more costly.

22. Lucerne (*Medicago sativa*) has been successfully grown and produces a valuable fodder, but the price of it has as yet not been determined. It can be kept on the land for a considerable length of time (three or four years) and will leave it in a better condition for growing cereals than before.

23. In conclusion, there is, I have shown, no want of suitable fodder-producing plants amongst those grown commonly by the South India cultivator, but he does not make use of the opportunities before him nor avail himself of the gifts that are given him. The importance of the industry is great, and the sooner it is introduced the more advantageous to the country. Until it is introduced we cannot hope for the development of powerful breeds of cattle wherewith it will be possible to improve economically the cultivation pursued in one of its greatest failings; and with its introduction we may hope to see, what is not seen now—a marked increase of the number of cattle supported by an acre of arable land. The power to perform deep culture, and the manure wherewith to grow good crops are both required; neither of those will be attained without larger and better supplies of fodder than at present exist.

SYDAPET,
14th September 1877.

(Signed) CHARLES BENSON, M.R.A.C.

THE PERNICIOUS EFFECTS OF THE USE OF CATTLE DUNG AS FUEL.

1. The use of bratties (thin cakes) made from the solid excrement of cattle is general throughout India. The consumption of this fuel is enormous and may practically be said to include the whole of the fæces of the cattle of the country, excepting a little that is dropped whilst they are being depastured at a distance. The collection is carried on unremittingly and most meritoriously, for, everywhere and always, women can be seen collecting the precious substance on the high roads and in the fields.

All solid excrements burnt.

2. The collection of the manure dropped on the roads is the only good point which this habit of the nation brings into operation; for, if it were not collected as it is for fuel, the manure would in all probability be totally lost, the inorganic as well as the organic constituents, which are now dissipated so wantonly when it is burnt.

3. There are in this Presidency about 8¼ million head of horned cattle, the solid excrements of each of these may be said to amount to about 8,000 lbs.* per annum, of this mass 85 per cent. will be water, the remainder dry organic matter and ash. The mineral constituents will amount to about 2·25 per cent., the rest being dissipated in the process of combustion. One-half at least of the excrements are dropped whilst the cattle are penned at night, when they should be in their stalls; thus the amount of dry organic matter wasted annually per head of stock is about 500 lbs., amounting to a total for the whole Presidency of 1,840,000 tons.

Organic matters lost in this Presidency.

4. This loss of organic matter affects the powers of the soil in more ways than one. For, leaving out of consideration the loss of plant food, organic matter is known and has been proved to influence the capacity of the soil to absorb and retain water to a very great degree; a most important matter for consideration in this country where droughts so often destroy or injure the crops.

Physical action of organic matter.

5. Organic matter also opens up, and thus exposes, the soil to the influences of the atmosphere, which acting as they do, disintegrate its particles and render its constituents more soluble; it also furnishes in its decomposition organic acids, which act on the soil-constituents, and reduce them to a condition in which they are available for plant food, as well as on the nitrogen of the air and water causing the formation of ammonia in the soil, where it is immediately available for the development of plants.

Chemical action of organic matter.

6. Organic manure thus improves the physical state and texture of the soil, and also renders it a more fertile field for the roots of plants in which to search for their food.

7. The loss of plant food caused by the combustion of cattle dung, although at first sight, when the small percentage of ammonia which is the substance so lost is considered, may appear insignificant, yet, when it is remembered that annually for every head of cattle in the Presidency 12 lbs. of the life-blood of plants is thus dissipated into its primary elements, the sum total, wilfully, needlessly, wasted is enormous,—being about 44,000 tons.

Great loss of Ammonia.

8. The use of litter to absorb the urine voided by cattle whilst they are penned at night is seldom if ever thought of; and thus it is wasted and lost altogether unnecessarily, for substances suitable for litter are plentiful enough.

9. The value of urine as a source of plant food is undeniable. The amount voided will amount to at least 4,000 lbs.† per annum per head of horned stock in this Presidency. The composition of it,

Composition of urine.

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*Boussingault found that cattle voided about 20,000 lbs. of solid excrement per annum.

† Boussingault found that a milch cow voided 10,000 lbs. per annum.

although no doubt subject to variations caused by the age, sex, condition, feeding, and treatment of the animal, as given by the best authorities, is much as follows:—

Water	91·20 per cent.
Organic matter	6·20 „
Ash	2·60 „

The organic matters are most highly nitrogenized, and contain nitrogen amounting, when calculated as ammonia ($N. H_3$), to nearly one-third of the total quantity, or about 1·8 per cent. of the urine. A glance at the composition of the ash is sufficient to show how valuable it is, and how egregious the error is, in allowing it to be wasted.

Composition of the ash of the

Urine of the Ox.

Carbonate of Lime	1·1	per cent.
Carbonate of Magnesia	6·9	„
Carbonate of Potash	77·3	„
Common salt	·30	„
Sulphate of Potash	13·30	„
Silica	·35	„
Oxide of Iron and loss	·75	„

The very high percentage of potash salts, about 91 per cent. of the whole, immediately shows how important the preservation of the liquid manure is. Although it may be said that the figures given above are not the results of analyses of the urine of cattle fed and treated as those of this country usually are, and this shows the want of scientific inquiry into the matter, yet it tells us that the amount of potash salts in the urine is considerable, and these are altogether lost under the native system.

Loss of plant food due to waste of urine.

10. The waste of valuable plant food, from the neglect of preserving the urine of the cattle stock of the country, is very great, for, when it is considered that each animal must void at least 2,000 lbs. of urine per annum, whilst it is neither at work, nor grazing, and when the composition of this liquid is known to be so rich in ammonia and potash as it is, the fact is apparent. The amount of ammonia lost per head annually in the urine is not less than 30 lbs., and that of potash, taking half of the ash *only* to be composed of that mineral, not less than 25 lbs.

The total loss for the Presidency is represented about as follows:—

Ammonia	110,000 tons.
Potash	92,000 tons.

11. I have shown as yet the direct losses only, which may be summed up as follows:—

Organic matter in the fæces	1,840,000 tons,
Do. do. urine	370,000 tons,

Summary of losses.

or nearly two million and a quarter tons of a substance much needed in all the arable soils of the country, and one which under the native system of culture is seldom added to intentionally; the value of it is difficult to estimate, but cannot be put at less than Rupees 3 per ton, at which rate the total loss amounts to Rupees 66,30,000 per annum. The ammonia lost, although the total loss can scarcely be put down to the habit of burning cattle dung, amounts

In the fæces to	44,000
Do. urine	110,000
Total	154,000

Estimating that one half of the quantity only is wasted owing to this habit, and valuing the substance at Rupees 500 * per ton, the annual loss would be Rupees 3,85,00,000.

* Mr. J. B. Lawes, F.R.S., in England, values Ammonia at £75 per ton,
Potash £18·15 „

The waste of potash has been shown to be 92,000 tons, and none or very little of this need be lost, if proper means of preserving it were adopted; valuing it at Rupees 150 * per ton the total waste amounts to Rupees 1,38,00,000. Collating the figures given above I find that the total loss to the country annually is much as follows:—

Annual loss to country.

	Rs.
Organic matters worth	66,30,000
Ammonia	3,85,00,000
Potash	1,38,00,000
Total ..	5,89,30,000

12. Some persons have asserted that the practice, already alluded to, of collecting so much of the dung which would otherwise be lost, recompenses, the manure heap for the robbery it is subjected to, by means of the increased amount of ashes that are brought to it. Whether the ashes of the fuel of the people are ever returned to the soil to any considerable extent is a most doubtful matter, so that, leaving out of the question the loss of organic manure, and the fact that, if cattle dung were not used as fuel, wood † or some other substances leaving ashes would be, the practice is of questionable importance.

Ashes of day collections.

13. I have already estimated the solid excrements of cattle to amount per head annually to 8,000 lbs., assuming that seven-eighths of this amount is collected and made into bratties for fuel, and that four-sevenths of the collections are made at night from the excretions of the animals whilst they are penned, the following figures represent the total of wet dung collected in this Presidency;

Total collections of fæces.

From cattle at night	11,160,000 tons.
Do. during day	8,370,000 „
Total ..	19,530,000 „

Of this mass about 2·5 per cent. are mineral matters, which thus amount to 488,250 tons. The valuable portions of the ash are chiefly Lime, Magnesia, Potash, and *Phosphoric acid*, existing in the proportion of about 10, 2, 1, and 7 per cent., respectively. The amount collected of each of these constituents is therefore about;

——	At Night.	By Day.
Lime	27,900 tons.	20,900 tons.
Magnesia	5,600 „	4,200 „
Potash	2,800 „	2,100 „
Phosphoric acid	19,500 „	14,700 „

14. The ash of the day collections are, I have already said, supposed by some to repay the losses caused by using the cattle dung for fuel; valuing these ashes at the following rates;

	Rs.
Lime	15 per ton.
Magnesia	12 „
Potash	150 „
Phosphoric Acid ‡	200 „

and supposing that all of the ashes are returned to the soil the account may be shown to be nearly as follows,

Loss.		*Gain.*	
Organic matter. Ammonia. Potash.	Rs. 5,89,30,000.	Ash of day collections.	Rs. 36,18,900.
		Actual losses	Rs. 5,53,11,100.

* The ashes of wood contain from 5 to 20 per cent. of Phosphoric acid besides about 10 to 15 per cent. of Potash.

† Mr. J. B. Lawes, F.R.S., values Phosphoric acid £20·10 in England.

‡ *Note.*—These are taken from some figures compiled by Dr. Forbes Watson. The accuracy of the figures or their applicability to ordinary grains cannot be vouched for. Probably the samples they refer to were selected especially for their quality. No really reliable analyses of the ordinary food-grains of the country exist.

Thus, under the most favorable circumstances, when all the ashes are carefully collected and returned to the land, the loss from this system in this Presidency alone amounts annually to nearly 5 million pounds sterling. But, considering that at a favorable estimate at least one-half of all the ashes are never rendered available for plant food, the loss is nearer

Lime	3,500 tons.
Magnesia	700 „
Potash	850 „
Phosphoric acid	2,400 „

15. Leaving out the constituents of minor value, Lime and Magnesia, the total loss per annum in the Presidency of plant food from this practice is nearly as follows—

Ammonia	77,000 tons.
Potash	92,000 „
Phosphoric acid	2,400 „

of an aggregate value of about Rupees 5,27,80,000 *besides the organic matters*, the value of which, as I have already stated, it is most difficult to estimate, although it is well known that the deficiency of it in Indian soils is a point of incalculable detriment to their productive and drought-resisting powers.

16. There is another element which adds materially to the benefits of cattle dung as a source of manure, that is, the minutely divided state in which its constituents exist, and the consequent facility for its application to the land in a manner in which it is easily made use of by plants.

17. The importance of the three constituents which I have been referring to is shown clearly in the following table, giving the amount of each required in the formation of 1,000 tons of the following grains, respectively:—

—	Ammonia.	Phosphoric acid.	Potash.
Wheat	2·86	8·2	5·5
Maize	1·9	5·5	3·3
‡ Yellow Cholum (*Sorghum vulgare*)	1·48	8·56	2·07
Rice	1·15	1·7	·8
‡ Cumboo (*Penicillaria spicata*)	1·62	6·78	4·05
‡ Raggy (*Eleusine corocana*)	1·03	5·95	5·34
Maize straw	4·74	3·8	16·6

18. The figures given above, although they are probably often varied from considerably in different samples, are yet sufficiently accurate to serve as a type, and in looking at them it must be remembered that, although an excess of one constituent in the soil may slightly alter the relative quantities of other constituents taken up by a plant, the proximate composition is always nearly the same. The figures show a great demand for Phosphoric acid, and with reference to this want, the supplies of cattle dung are totally inadequate to supply a sufficient quantity of that substance; and the necessity of rendering every possible source of it available, for instilling into the intellects of the cultivators the urgent necessity for the use of bones, wood and cattle dung ashes, and night-soil as manures, and for the investigation of the question of the existence of phosphatic guanos, like those found in South Carolina, coprolities, apatite, or any other source of Phosphoric acid in this country is most evident.

Great want of Phosphoric acid.

19. It has been asserted by some authorities that "it is difficult to see whence a sufficiency of manure is to be procured" wherewith to manure the irrigated lands, in order that the water at present used may be economized. I have shown, if this pernicious habit were put a stop to, that at least 2,210,000 tons of dry organic matters would annually be rendered available as manure, an amount which would equal at least $3\frac{1}{4}$ million tons of manure (excluding litter), or a supply of $\frac{3}{4}$ ton per acre per annum to all

Organic manure sufficient to halve water required for paddy crop.

the paddy lands of the country of what they most require. If this manure were applied regularly for 12 years I venture to assert that half the present quantity of water used would suffice to raise heavier crops of paddy. Trees would have to be very extensively planted, if the use of cattle dung fuel were stopped and thus the supplies of leaf manure would be vastly and annually increased.

20. I have confined myself as yet to pointing out the pernicious effects of the habit, how it may be avoided should also be shown, as well as how it might be put a stop to. Cattle dung is apparently used as fuel for two reasons, firstly, because it is often seemingly cheaper to the consumer and perhaps more convenient; secondly, from habit, instilled into the ways of the people for many generations. The reason why it is cheaper than fire-wood is the want of that article, which want could be easily avoided by planting much of the inferior soils which now produce, if anything, only a very scanty and low class of pasturage, but which could easily be brought to grow trees; by this means the soils would be improved, the decaying leaves increasing the organic matter in them; and also as the roots of trees seek deeper down for their supplies of nourishment they would render a greater field available from which to draw plant food for the growth of our field crops. The practice pursued in Japan of causing three trees to be planted for every one felled is worth mention here.

Growth of trees improves soils.

21. The use of cattle dung fuel by any one for any purpose can be rendered unnecessary, and how to render it unnecessary is, in my opinion, a most important question; it can be rendered a luxury by adequate planting of fuel trees. To bring about this much-to-be-desired reform, something, more than the present encouragements held out to persons who plant trees, should be done; if it be impolitic to enforce the planting of portions of every village with fuel trees, which is doubtful, it cannot be to place a tax, on the cattle dung used as fuel, to be annually increased in amount as the chances of having supplies of fuel from other sources have been added to, time being allowed for the growth of trees. Toddy and arrack are taxed, why should not a habit, even more detrimental to the well-being of the country than the consumption of spirits, and which can be rendered greater luxury? The profits of such a tax would in a measure repay the interest of the outlay on the famines which are so much intensified by this habit. The price of fire-wood in Sydapet is about Rupees 7, and that of bratties about Rupees $17\frac{1}{2}$ per ton; the reason for the use of bratties is explained by the fact that, the dung being collected by the females of the family, no disbursement is required to obtain a supply. Supposing that a tax of Rupees 2 per ton were imposed on their manufacture, an income, if the present rate of consumption continued, would accrue of over 90 lakhs of Rupees, an amount equal to the total excise and customs duties of this Presidency. Good fire-wood, equal in quality to that of the Casuarina, should be obtainable in ten years in all parts of the country at Rupees 5 per ton, which amount might be fixed as the ultimate rate for the bratty tax.

Cattle dung fuel should be rendered a luxury.

SYDAPET,
30th August 1877.

(Signed) CHARLES BENSON, M.R.A.C.

THE PHYSICAL* PROPERTIES OF THE SOIL AS INFLUENCED BY TILLAGE AND THE APPLICATION OF ORGANIC MANURE.

1. The soil must be regarded in a two-fold aspect, first with reference to its chemical composition, and secondly in respect to its physical properties. Few plants of any value, except the arboreous kinds, attain any degree of perfection in an uncultivated soil, since the soil in its natural state seldom possesses the chemical composition and physical properties, necessary for the production of cultivated crops.

2. In most instances, one or more of the elements essential to the vigorous growth of plants, are not to be found, or, if present, are either deficient in quantity, or exist in combinations, in which they cannot be absorbed, or that are injurious to the growth of plants; or, again, the physical condition of the soil is such as to render these elements altogether ineffective. The chief object that occupies the attention of the Agriculturist is the removal, or the diminution, of these defects of the soil, and this is effected by mechanical operations, by tillage, the application of manure, &c.

3. Whether the adoption of one or other of these means should receive the greatest amount of attention depends firstly, and chiefly, on the state of the soil; then, on the speciality of the crop to be raised, as well as on the possibility of realizing a return, equal to the sum spent on labor, &c., in the production of the crop; the ability of the cultivator, and other circumstances often most difficult to determine. Generally, the application of manure tends to supply one or more of the elements that constitute the food of the plant which may be deficient in quantity. Tillage tends to render the existing food, in inert chemical combinations, available for the plants as well as removes the injurious tendency of other chemical ingredients, it improves also the physical qualities of the soil, exterminates weeds, &c. But, manures are often applied for the purpose of improving the physical properties of the soil and as solvents for the inert chemical combinations. The first process, is nearly always accompanied with good effect, but the latter, if carried to excess, is apt to impair the fertility of the soil and may in the course of time render it unprofitable for future cultivation. There may be many cases where, even under high cultivation, an addition of manure would not increase the production of the crop, the soil being naturally so rich that without manure the highest possible produce is obtainable, but very rarely will it occur that without mechanical operations and proper tillage, a produce at all satisfactory will be obtained. A soil, judged by its chemical composition, may be deemed very fertile, yet in reality be unfit to produce anything, until its physical qualities are improved by proper tillage.

4. The conditions of fertility are very varied; the presence in the soil of the food of plants is important but, the physical properties of the soil frequently possesses a greater importance. To this, must chiefly be attributed the failures that resulted from too hasty conclusions, drawn from chemical analyses of soils, by certain enthusiastic admirers of chemistry, who believed, that the presence in the soil of those elements that constitute the plant food was sufficient to determine the question of its fertility. For the purpose of obtaining the highest possible produce, the soil is broken up by various tools and instruments, pulverized and made mellow, &c., so as to suit each special want.

5. The more the science of agriculture is advanced in a country, the more is recognized the importance of thorough tillage, which in such places has been extended even to forest land, especially since the value of forest conservation has come to be thoroughly understood and appreciated.

6. The most important result obtained by tilling the ground is, the improvement of the physical properties of the soil, because the chemical actions will only then have full play when the atmospheric air can freely circulate in the soil. The soil, considered generally, is an accumulation of fine molecules invisible to the eye, and

* In the last Annual Report (1875-76) will be found some valuable results obtained by Mr. Schiffmayer that afford much information regarding the physical properties of soils.

representing a fine powder or dust. This accumulation of fine particles, being the product of the complete disintegration of rocks, represents the essential part of the soil, and is mixed with grains of sand more or less large intermingled with fragments of rock. This pulverized mass with the less decomposed fragments of rocks constitutes the geognostic base of the soil, and from the occurrence of organic matter in the top-layer, we distinguish generally between surface and subsoil. The pulverized mass and the finely-distributed organic matter determine chiefly the physical properties of the soil.

7. If grains of soil, more or less round, lie together, they come in contact only in a few points, of their surface, between them are spaces or interstices. Even melted metal possesses these interstices between its molecules. In the soil, these interstices are of the utmost importance, because, if the circulation of air is not prevented, they are filled with air and determine the porosity of the soil. Every solid substance attracts gases and condenses them under certain conditions.

8. As attraction, is a function of the material's surface, it is evident that the effect of the attraction, depends on the area of the surface. The more pulverized a soil is, and the more pores it contains, the greater surface does its particles exhibit and, consequently the more gases can such a soil absorb. For this reason sand absorbs much less gas than clay, and a well-tilled and pulverized soil more than a soil roughly ploughed. Consequently a soil deeply tilled absorbs more than one that is shallow tilled. It has been ascertained that the lower the temperature of the soil, the greater is the absorption that takes place, and to this circumstance chiefly is attributed the beneficial effects that a low temperature produces on the soil, a fact with which every practical farmer in Europe is familiar. With regard to absorption of atmospheric air, it may be mentioned that oxygen and nitrogen are both absorbed by the soil, to a limited extent.

9. Although the attraction of oxygen is not intense, the readiness with which this gas enters into combination is the cause of a great amount of oxygen being absorbed. The particles of soil condense the oxygen on their surface and this entering into chemical combination with them oxydation takes place. By oxydation the free oxygen is removed and the particles of the soil are thereby enabled continually to absorb fresh oxygen. When the surface of the particles of soil is not oxydable, the absorption is only trifling. Most soils, however, are made up of constituents favoring the absorption of oxygen, especially such as contain inferior oxydes of iron and humus.

10. Protoxyd and other inferior combinations of iron are highly qualified to absorb oxygen, provided the circulation of atmospheric air is favored by frequent and deep tillage.

11. A soil possessing a large amount of iron as protoxyd in the subsoil, may, when this is brought suddenly to the surface, exhibit for a certain time indications of barrenness, but this is not on account of any obnoxious or poisonous quality of the combinations of iron, but must, chiefly, be attributed to the fact that all the oxygen of the air circulating in the soil is absorbed by the protoxyd to form higher combinations of iron, so that little or none is left available for the roots of the plants. It has been clearly shown that the roots of plants always keep up respiration. The plant is enabled to grow more rapidly and yield much more when there is an unlimited supply of free oxygen in the soil. An experiment made by Stockhardt demonstrates how much the yield of a crop depends on a liberal supply of atmospheric air. He filled two cylindrical glasses measuring 2·5 feet in height and 5·5 inches in diameter each, with soil. In each cylinder was sown five grains of oats and three of peas. One of the cylinders was perforated at the bottom which was brought in connection with a gasometer filled with atmospheric air. The vegetation period extended from 14th of June until the 3rd of October during which time the soil in the perforated cylinder received daily 1,000 cubic centimeter of atmospheric air from the gasometer, whilst the soil in the other cylinder could receive atmospheric air only from its surface. Besides this, both cylinders remained under equal conditions; the soil was a loamy sand containing much humus. The outturn on dry plant substance was as follows;—

Without additional supply of atmospheric air.	Grammes.	*With additional supply of atmospheric air.*	Grammes.
Five plants of oats	3·90	Five plants of oats	7·65
Three do. of peas	1·72	Three do. of peas	2·46
Roots of both	0·27	Roots of both	0·38
Total ..	5·89	Total ..	10·49

The soil receiving a liberal supply of atmospheric air produced twice as much as the other. The circulation of atmospheric air in the soil promotes in a special manner the development of the roots. Sohuhmacher found that barley plants, which he grew in a pot provided with a tube to conduct atmospheric air to their roots, had produced roots three times as heavy as other plants grown under the same conditions but not provided with a tube.

12. The need of oxygen for respiration varies very much in the different species of plants, but, as a rule, the more valuable species require more than the lower kinds. From this it is evident that it is impossible for the higher types of plants to thrive as long as they have but a limited supply of the element most essential to their growth. A soil containing much protoxyd of iron is therefore the most in need of frequent and deep tillage, in order that oxydation should take place in the shortest time to enable the roots to penetrate to a greater depth in order to come in contact with a greater amount of vegetable food and to meet the other conditions necessary for the healthy growth of the plant. In most cases with such a soil, especially in climates with little change of temperature, deep tillage should be gradually effected. To fallow the land for a certain period, frequently ploughing and stirring up the soil in the meantime, greatly promotes its disintegration. It has been ascertained that oxygen is but slightly absorbed by sand, gypsum, and calcareous earth, but largely by clay, and in the highest degree by humus. An experiment made by Herman gives some idea as to how the oxygen acts upon humus. He brought 28 volumes of wood that had commenced to rot under a bell-jar which contained 262 volumes of air. The wood remained under the globe for 10 days at a temperature of 27 degrees (Centigrade) after which time the volumes of air remained the same but the air contained less oxygen and more Carbonic Acid. The component parts of the air under this experiment may be exhibited as follows;—

Before the experiment.		*After the experiment.*	
Nitrogen	207 volumes.	Nitrogen	194 volumes.
Carbonic acid ..	*Nil.*	Carbonic acid ..	40 „
Oxygen	55 „	Oxygen	28 „
	262 „		262 „

The chief results of the absorption of oxygen by the soil is the disintegration of mineral fragments, the decay of organic matter, and the supply of this element for respiration of the under-ground parts of the plant. The absorptive power of the soil may be increased by deep and frequent ploughing as well as by the addition of such materials as clay and organic matter which possess the quality of absorbing gases in a high degree.

13. The ammonia of the atmosphere is absorbed in the same way as oxygen and nitrogen, viz., by the surface attraction of the particles of soil. The ammonia absorbed by attraction is soon converted into Nitric acid by oxydation, and probably ammonia enters also into other chemical combinations and remains as ammonia in complex combinations (silicates). Considering the fact that the atmosphere contains but a small quantity of ammonia, the absorption of this element by the soil cannot be great. Carbonic acid behaves similarly to ammonia in the process of absorption. The air of the soil contains much more Carbonic acid than the atmosphere, the absorption of this gas is very great in clay soil owing to its capacity to absorb Carbonic acid. It is even possible that in a sandy soil, which has been newly manured with organic matter, the air of the soil should possess so great an amount of Carbonic acid that it may be

partly lost by diffusion into the atmosphere. For this reason light and frequent manuring with organic stuffs is especially adapted for sandy soils, whereas a clay soil, which possesses the power of absorbing a great amount of Carbonic acid may, without much risk, receive a heavy manuring. 1,000 volumes of atmospheric air contain 4 volumes of Carbonic acid. Boussingault and Lenis found that in newly-manured soil, after rain, the air contains as much as 9 per cent. of Carbonic acid.

14. Of far greater importance than the absorption of Carbonic acid is the absorption of water gas from the atmosphere. Atmospheric air always contains a certain amount of watery vapours which are attracted and absorbed more or less by solid substances, of which such as possess this quality in a high degree are said to possess a great hygroscopic power. Porous substances absorb a great amount of watery vapour. The hygroscopic power of the soil is considerable, clay absorbs 6 per cent. and humus, in form of peat, as much as 24 per cent. of its weight, in watery vapour. The more clay and humus a soil contains the greater is the absorption. It was found that a sandy soil, containing much organic matter, absorbed 70 per cent. of its weight in water, but after being ignited only 0·12 per cent. This illustrates the importance of organic matter in the soil especially in hot climates. A soil having much organic matter may, when properly tilled, in many instances, receive all the water required for the production of crops by air irrigation, that is to say, the atmospheric air circulating freely in the soil can supply all the water needed by the plants. When we remember that it has been found in Europe that plants often exhale, from their leaves, up to seven times as much water as they receive by rain, *so that about 80 per cent. of this water must have been absorbed from the atmosphere*, it must be admitted that the absorption of watery vapour by the soil is a power of nature deserving the greatest attention. The hygroscopic power of the soil, depends not only on the nature of its chemical constituents but, in a great degree on its mechanical condition; the soil can only then absorb moisture, when the air is allowed to circulate in it; the deeper the earth is broken up, and the more it is pulverized, the more freely will the air be able to circulate and the greater will be the absorption. Clay absorbs more moisture than sand, the particles of this soil being much more fine and numerous and each forming, so to speak, the centre of a watery vapour zone. The more moist the atmosphere is, the more moisture will be absorbed, and to this circumstance must be attributed the fact that islands, and places situated near the sea, frequently produce the most luxurious crops, even with little or no rain-fall. The lower the temperature the more moisture can be absorbed, and therefore, in hot climates the soil will absorb a larger quantity of moisture during the night, than in the day. Many soils cannot absorb any moisture during the day when the atmosphere is very dry and the soil contains little organic matter.

15. But the great change in temperature during day and night, observable, generally in hot climates, is most favorable to absorption; since, by the sinking of the temperature of the soil during the night, the watery vapour enveloping the particles of soil is condensed to liquid water, the formation of dew takes place, which penetrates the earth, and the soil is thereby enabled to absorb and condense watery vapour continually, so that although the attraction of watery vapour in a hot climate is less than in a cold one, the total amount of absorption, may be much greater in the former than in the latter.

16. Another important improvement effected by deep tillage is the increase of the capacity of the soil to hold liquid water. This capacity depends entirely on the porosity of the soil, that is, on the number of the capillary tubes or spaces the soil contains. As shown before, every soil, even when its particles are divided to the utmost, possesses spaces between those particles. These interstices determine the capillarity of the soil. They are of various dimensions, some being so small as to be able to hold water between them which are called capillary spaces of the soil. The larger ones have no capillary qualities and are under ordinary circumstances filled with air; the more capillary interstices a soil contains, the more water can it hold. One cubic foot of soil containing much rough sand possesses much fewer capillary interstices than a cubic foot of pure clay soil. The interstices of the latter are all capillary and such a soil can hold a greater amount of water, a quantity that may be beneficial or

injurious according to circumstances; on the whole, it would be more beneficial in a dry climate than in a wet one, where great moisture, caused by heavy rain-fall, very often proves a serious impediment to the production of plants. The occupation of all interstices by water, prevents the air from circulating in the soil, and the great amount of heat that becomes latent by the evaporation of the water makes the soil cold, a term used and well understood by practical Agriculturists.

17. The reduction of the heat of the soil, so undesirable in cold and humid climates, is a desideratum to the Cultivator in a warmer region. For this reason a clay soil possessing a great amount of organic matter, in order to create larger spaces for circulation of the air and to facilitate tillage, is the best adapted for a warm climate, by taking up the greatest amount of rain-water falling, generally in long intervals, and by allowing it only gradually to evaporate, thus keeps the soil to a certain degree, moist and cool. Of all soils, clay possesses the qualities which under every circumstance admit of most improvement by tillage. In hot climates, the rain falling with great force to the ground closes the surface of clay soil more or less, thus preventing the admittance of air which is the most essential factor in vegetable life. The clay, with its fine capillary tubes, displaying a great tendency to attract the water allows that fluid only slowly to pass into the soil, so that, when a rather heavy shower of rain falls, the water collects on the surface and converts the very fine particles of soil into a viscid paste covering the whole surface with a dense sheet impervious to water and which after becoming dry forms a crust that precludes the admittance of air. The chief cause of the formation of the crust is the evaporation of the water. It is well known that the height to which a liquid can rise in a capillary tube depends on the diameter of the tube and the chemical composition of the liquid, but, the fact that the temperature of the liquid and of the tube, is a principal agent in this process, is perhaps not so well understood. Wolf, who made minute investigations in this direction, found that the higher the temperature of the liquid or of the capillary tubes is, the less will be the height to which the liquid can rise. This is proved to be the case in Indian soils, where the salt rises to the surface of the land especially in the cold season after the heavy rains, that have reduced the temperature of the soil are over, and very little after the rains in the hot season. Generally pure water rises higher in the capillary tubes than a solution of salt; a concentrated solution can only rise to a considerable height in very narrow capillary tubes, and at a low temperature. It is evident that the clay soil whose interstices, owing to its fine particles, represent very narrow capillary tubes, is best qualified for the passage of the salt, from the subsoil to the surface. When after the rain in the cold season rapid evaporation takes place the minute capillary tubes, between the fine particles of the clay, possess so much attraction as to allow the solution of salt to rise to the surface from a considerable depth. There is no doubt that a soil saturated with water, possessing no drainage, promotes the rise of salt, because, much more evaporation taking place a larger amount of salt is conveyed to the surface, and then, the large amount of water in the soil being less saturated with salt on account of its abundance, is capable, as shown above, of rising to a great height. The force of the falling rain may produce a similar effect by beating down the soil and thereby reducing the size of the capillary tubes. A soil possessing more than a certain percentage of soluble salt in its upper surface is unfit for the production of the higher species of plants. It has been found by the artificial culture of plants in water, that the concentration of the salt solution should not be more than 0·5 per cent., though the water in the soil may probably contain a higher percentage of salt without proving injurious to the plant. As the minute capillary spaces are the vehicle by which the salt is conveyed to the surface, it is evident, from the foregoing consideration, that by reducing the number and enlarging the size of these spaces, only a small proportion of salt, if any, would be able to reach the surface. We have it in our power to effect this, by deep and frequent tillage, and, the addition of such matter as will reduce the capillarity of the soil, by enlarging the interstices to such a degree as to exhibit very little adhesion to the salt solution and thus render it incapable of rising. Drainage, is another means of counteracting the rise of salt to the surface by preventing the too great accumulation of water in the soil. By tillage the spaces of the soil become greater rendering the soil loose, so that many of

them losing their capillary power entirely, are rendered unable to conduct the salt to any height. The deeper the tillage and the more open the soil is kept, the more will this end be effected. It is true the dissolved salt will, if the subsoil be impervious remain immediately below the strata operated on by the plough but this may be let off by drains cut at certain depths. A soil constantly kept open will not only prevent the rise of the dissolved salt but to a great degree also that of pure water so that such a soil will keep the moisture longer than one whose capillary spaces are small. The crust, formed after rain should therefore be broken up as soon as the condition of the soil will permit it, in order that the capillary water-level may be kept lower and the admittance of atmospheric air be facilitated. It must be admitted that the capillary water evaporates into the larger interstices filled with air and is apt to be diffused to some extent in the circulating atmospheric air, especially when this is very dry.

18. The injurious effect produced by dry parching winds may be easily neutralized especially when blowing always from the same direction by planting some rows of trees or a good hedge on the side from whence the wind proceeds; and this will not only preserve the soil from becoming too dry but will also increase its capacity for absorbing moisture from the air. The benefit to be derived from deep ploughing will be especially manifest with regard to the falling rain. In climates subject to drought it is of the utmost importance to utilize every drop of water that falls from the clouds. Sandy soils (if the grains are not very fine), are sufficiently porous to admit of the passage of the rain-water into them. The finer the grains are, the more will the passage of water be impeded so that if the showers of rain are heavy, most of the water will run off from the surface. It is often to be observed that after a heavy shower of rain of perhaps $1\frac{1}{2}$ inch, a soil of this kind which should be saturated to a depth of about 6-7 inches has become wet only to a depth of 2-3 inches, the texture of the soil having become so close as to admit only about one-third of the falling rain the other two-thirds having run off and been utterly lost. This may be observed even in fields whose surface is nearly level. A section taken from such a soil after rain in the dry season will exhibit its upper layer to the depth of some inches as excessively wet and the layer below completely dry, both which conditions impede the growth of plants.

19. As soon however as the soil is properly tilled to a great depth so as to have wider spaces between its particles, the falling rain following its gravity will pass freely into the soil and extending down to a great depth will administer moisture with a greater degree of uniformity, and thus avoid excessive humidity. As a soil of this description is very apt to close again, and can only be effectually worked under certain conditions, the greatest attention is required in order to keep it in a state favorable for that purpose. A great amount of organic matter will however tend to remove all difficulties, and to render the soil so loose as to admit a large quantity of water, the free entrance of air and spreading of the roots of the plant will thus be facilitated and the soil be in a condition to be worked almost at any season. By deep ploughing, the roots of the plants will be encouraged to penetrate deeper into the ground, thus coming in contact with a much greater amount of plant food and a more regular supply of water resulting in the production of a more abundant crop. It would not be too much to assert that in many places, if the subsoil is not much inferior to the surface soil, one deep ploughing or subsoil ploughing every year, perhaps only every second year, with frequent stirring up of the upper soil and adequate manuring in the meantime would produce a double and perhaps even a three-fold yield of crop. When the roots are prevented from striking down into the subsoil, the plants will suffer from every change of weather and temperature, their roots not meeting with either a sufficient amount of plant food or water in such a limited space. Many crops cannot attain maturity on account of suffering from the bad effects of shallow tillage, for the evaporation of water from the plants being greater during the day than what the soil can store up the preceding night, the tissues of the plants become contracted to such a degree as to be rendered unfit to perform their functions of imbibing water again, so that the plants wither and die. Other plants again will commence flowering when scarcely half grown, the little moisture at the disposal of the plants under shallow tillage not sufficing for the formation of new organs or the completion of their growth.

Great dryness, is favorable to flowering and the production of fruit, but here the material for the formation of the seed is not prepared and the plants must succumb before attaining this stage of development.

20. A soil exhibiting a hard close impervious pan will hold less water than it will hold after it has been pulverized; but when made very loose many of the interstices will become so wide as not to be able to exercise any degree of capillary attraction.

21. With rough sand however, the case is different, its grains when lying loose together exhibit large spaces possessing little capillary force, but which becomes greater on the sand becoming more compact, so that the capacity of the same soil may vary more than 10 per cent. The capacity of agricultural soil to hold water varies from 20 to 100 per cent. of the weight of the soil; the former estimate referring to a sandy soil, and the latter to a clay soil which is very rich in organic matter.

22. Of course the capacity of a sandy soil to hold water depends chiefly on the largeness of its grains. Nearly pure but very fine sand may hold as much as 30 per cent. of its weight in water. A soil having its capillary tubes filled with water for some length of time can only produce aquatic plants such as grow in marshes.

23. Most plants, especially those of the higher type, will thrive only in a soil alternately saturated and dry, whilst other species can accommodate themselves to any circumstances. Some plants that have vegetated only under dry cultivation may nevertheless in the course of time gradually change their character altogether and become aquatic plants and *vice versâ*. Of all plants rice is the most capable of bearing a saturation of the soil for a long period and so with meadow herbs and grasses; yet these also, especially the higher varieties, will thrive best in a soil which is sometimes saturated.

24. There can be no doubt but that every species of plants and even each variety possesses certain peculiarities, as regards the amount of water in the soil conducive to its growth, which vary according to climate and soil. In this view the soil will only then yield the most abundant crop when this speciality of the plant is satisfied. The soil after being saturated with water loses a portion of it more or less rapidly according to the degree in which the water adheres to the soil. The evaporation is very rapid during the first few days, when a sandy soil possessing little organic matter may lose as much as half of its water. The more organic matter and the more clay the soil contains the more slowly will the water evaporate, so that such a soil contains for a long time after saturation has taken place as much as $\frac{1}{3}$-$\frac{1}{2}$ of the amount it held at first; whereas a sandy soil, poor in humus, will retain only $\frac{1}{8}$-$\frac{1}{10}$ of its water under similar circumstances.

25. The relation between the capacity of the soil to hold water and its vegetative power, depends very much on the quality of the soil. One of a sandy or loamy character, possessing much organic matter, may hold as much as 80-90 per cent. of water and may be more favorable to vegetation than a clay soil holding only 60-70 per cent., since the former being more loose encourages the evaporation of water as well as the circulation of atmospheric air. Loose soil may hold 100 per cent. water. In a soil containing a greater amount of organic matter, certain species of plants may grow as long as it contains not less than 10 per cent. of the amount the soil can hold, the absorption of the atmospheric moisture replacing the consumption. The limits between which the water in the soil may vary, without being injurious to vegetation by either too great dampness, or dryness, depends on the nature of the soil.

26. Loose sandy soil possessing $\frac{1}{2}$-$\frac{3}{4}$ of the water it can hold, appears best suited for most plants, whereas clay soil, unless possessing much organic matter, will be injurious to the growth of most plants if it contains for a long period as much as half the water it is capable of holding. There may be cases where the soil contains a small percentage of water and is even unable to absorb a considerable amount of moisture from the atmosphere and yet the plants growing on it will be found to thrive wonderfully well. In these instances the water needed is supplied from the under-ground water-level. It may be observed that water cannot rise higher than three feet by capillary

attraction. In sandy soils it seldom rises higher than one foot, so that when the subsoil water-level lies lower, the water can only rise in the form of vapour. Water is converted into vapour at every temperature. If the subsoil contains water and the upper soil is dry, the water gas rises through the capillary tubes to the upper soil, but if the temperature of the upper soil is lower than that of the subsoil, the water gas becomes condensed to liquid water in the form of dew. As the temperature of the upper soil generally sinks during the night below that of the subsoil, a considerable amount of water may rise to the surface soil and be condensed there, especially when the subsoil is open and the water-level does not lie too deep. It has been found that in a glass tube measuring five feet in length and two inches in diameter which was filled with sand, the water rose by capillary attraction to the height of 7½ inches. The upper part of the tube was exposed to direct insolation, yet after eight days' exposure the moisture in the upper layer was not changed. All the water evaporated from the surface was here replaced by the watery vapour rising from the subsoil through the capillary spaces, which has become condensed in the surface soil to liquid water.

27. The foregoing cursory exposition of some of the physical properties of the soil, will, it is hoped, serve to prove the important share which the physics of the soil claim in reference to the cultivation and production of plants, a science worthy to hold a place by the side of Agricultural Chemistry, but which has, unfortunately, been utterly neglected in India, to the detriment of the Cultivator.

28. Again and again, have men of science pointed out the danger accruing from a disregard to the laws of nature, as influencing the physical condition of the soil, a neglect which is less felt in localities possessing a rich virgin soil and a favorable climate, but infinitely more in countries where vegetation depends in a great degree on the physical properties of the soil. It may often happen that the capacity of the soil to absorb moisture from the atmosphere is of itself sufficient to decide the question as to whether a crop can be grown on it or not, whether animal life can find the means of subsistence, or must be left to perish.

SYDAPET,
13*th October* 1877.

(Signed) K. SCHIFFMAYER,
Asst. Supt., Govt. Farms.

SOME MANURAL SUBSTANCES YET UNUTILIZED IN THIS COUNTRY.

1. In previous Reports, attention has been directed to the manural value of lime, saltpetre, salt, oil-cake, aquatic weeds, tank scourings, brick-kiln ashes, &c., substances, which are either altogether unused in our agriculture, or are used only to a very limited extent, and; most of which can be obtained in some quantity, and at reasonable prices, over the greater part of the Presidency. I would now invite attention to other fertilizing matters that, are equally neglected by our cultivators, and which, are all procurable in considerable quantities and, at little cost. These are ;—human excreta, the refuse matters of slaughter-yards, and, the remains of animals.

2. *Human Excreta.*—There is an enormous loss of fertilizing matters in this country in the total waste of the excreta of man. In the plains they are very seldom collected for use as manure. In large towns they are, of course, always collected and removed from human habitations but, in such cases they are simply buried in the ground in some convenient locality, not however in view to their future utilization. In the villages, and throughout the rural districts generally, these matters are not even collected, but left to waste away where deposited; the result of the practice is, that the waste land, in close proximity to the larger villages, is frequently in a very disgusting state.

Human excreta wasted.

3. We have, unfortunately, in this country, no satisfactory data by which we can determine the exact manural value of human excreta ; but in Europe, during the past twenty years, such matters have received great attention from Chemists. In a paper, on the Agricultural value of Earth Closet Manure, published in the Journal of the Royal Agricultural Society of England, Dr. Voelcker, F.R.S, the Consulting Chemist of the Society, has discussed very fully the chemistry of human excreta. He says ;—

Dr. Voelcker's opinion of the manural value of human excreta.

"Their composition, I need hardly say, is subject to considerable variations ; and consequently all calculations based upon analyses of these matters are liable to considerable fluctuations. Speaking generally, solid human excreta, as they leave the body, contain about one-fourth of dry matter and three-fourths of water. The dry matter contains about 1½ per cent. of nitrogen and 1 per cent. of Phosphoric acid.

Composition of human excreta very variable.

"According to Professor Way, human fæces, in a recent condition, are stated to contain in 100 parts ;—

Water	75·00
Organic matter *	22·13
Insoluble silicious matter	·37
Oxide of iron	·13
Lime	·43
Magnesia	·38
Phosphoric acid	1·07
Sulphuric acid	·06
Potash	·30
Soda	·08
Chloride of sodium	·05
	100·00

"If it were possible to dry fæces without loss in fertilizing matters, and without the addition of bulky materials, they would, in a dry state, be a very valuable manure, for in that state they would contain ;—

* Containing nitrogen 1·50, equal to ammonia 1·82.

Organic matter*	88·52
Insoluble silicious matter	1·48
Oxide of iron	·54
Lime	1·72
Magnesia	1·55
Phosphoric acid	4·27
Sulphuric acid	·24
Potash	1·19
Soda	·31
Chloride of sodium	·18
	100·00

"It appears from the preceding figures that, in a perfectly dry condition, two tons of solid human excreta are worth almost as much as one ton of Peruvian Guano; and it seems a great pity that a manure possessing such a fertilizing value should be wasted as at present it is in a great measure.

High manurial value of solid excreta.

"Still more valuable as a manure is human urine, for its principal constituent—urica—contains nearly 50 per cent. of nitrogen; and uric acid—an active constituent of urine—contains about 33 per cent. of nitrogen; and besides these nitrogenous organic matters, human urine contains a good deal of Phosphoric acid.

Urine.

"Unfortunately urine enters very rapidly into decomposition, giving rise to foul-smelling gaseous products of decomposition, and to volatile carbonate of ammonia; and on keeping, loses much of its most valuable constituents. The collection and preservation of urine, in consequence, is attended with practical difficulties, which are greatly enhanced by the trouble and expense of getting rid of the large proportion of water which urine naturally contains. For these reasons, all attempts to collect urine and to obtain from it a solid manure by evaporation have hitherto proved failures in an economical point of view.

"Fresh urine contains, on an average, only 3 per cent. of solid matter, and, according to Professor Way's analysis consists of:—

Water	97·000
Organic matter‡	2·026
Insoluble silicious matter	·003
Oxide of iron	·002
Lime	·018
Magnesia	·014
Phosphoric acid	·040
Sulphuric acid	·014
Potash	·055
Chloride of potassium	·162
Chloride of sodium	·566
	100·000

"Notwithstanding this large proportion of water, the amount of solid matter in the urine voided in a day is just about one-third greater than the amount of dry matter in the daily solid evacuations.

"It is not easy to calculate with great precision what is the total amount of fæces and urine which is produced by a mixed population of adults and children of both sexes; but it may be safely stated that the amount of dry matter in the solid and liquid excreta of a mixed population does not exceed 56 lbs., per head per annum, and that probably it is not more than 45 or 46 lbs. In some experiments which Professor Way made upon adults, he found that an individual voids in 24 hours about ¼ lb. of fæces and 3 lbs. of urine. Assuming the preceding analysis fairly to represent the composition of the solid and liquid excreta of man, and each person of a population to produce ¼ lb. of fæces and 3 lbs. of urine in 24 hours, we obtain in

Solid matter in excreta.

	Per Annum.
4 oz. of fæces 1 oz. of dry matter, or in round numbers nearly	23 lbs.
And in 3 lbs. of urine 1½ oz. of dry matter or in round numbers nearly	34 „

"Thus the liquid excreta of man contain one-half more dry matter than the solid.

"On calculating the amount of ammonia which will be produced on the decomposition of the dry matter of the solid and liquid excrements of each person per annum, we obtain from the

* Containing nitrogen 6·00, equal to ammonia 7·28.

‡ Do. nitrogen ·58, equal to ammonia ·71.

	Ammonia.
23 lbs. of dry matter contained in the solid excreta	1·60 lbs.
34 lbs. of dry matter contained in the liquid excreta	8·12 „
or altogether ..	9·72 „

"In other words, five-sixths of the ammonia capable of being generated on the decomposition of human excreta is furnished by the urine. By a similar calculation I find that, according to the preceding data, each individual would furnish about 5½ lbs. of phosphates per annum. For simplicity's sake we may assume that each person of a population produces in the solid and liquid excreta 56 lbs. of dry matter per annum. These 56 lbs. produce in round numbers 10 lbs. of ammonia and 5½ lbs. of phosphates."

4. I offer no apology, for making such a lengthy extract from Dr. Voelcker's Report for, I believe it to contain the fullest and most valuable information available, on the agricultural value of the excreta of man; and, but few persons in this country are likely to have met with a copy of Dr. Voelcker's Report.

5. There must, of course, be a very wide difference between the manural value of the human excreta of this country and of that of Europe. In India, the food of the people is bulky and innutritious consisting chiefly of grain, animal food forming but an inconsiderable item.

6. The agricultural value of ordinary human excreta in this country, cannot but be low, from the known poverty of the food of the people. It is a well-ascertained fact that the quality of the food of man, or beast, determines the manural value of their excreta.

Human excreta bulky in this country.

7. The bulk of the solid excreta of man in India is said to be greater than in Europe; but it is improbable that it contains a larger quantity of solid substances. We may, I think, estimate that in this country the dry substances, in mixed excreta of man, will weigh, per head of the population, about 45 lbs. capable of yielding, on decomposition; say, 6 lbs. of ammonia and 3 lbs. of phosphates. Of course, these figures are but estimates, they are however based on the best information we possess.

8. From these figures, it would appear that the average value of the liquid and solid excreta of one person, of our mixed population of adults and children, is, as follows;—

	RS.	A.	P.
6 lbs. of ammonia at 6 Annas per lb.	2	4	0
3 lbs. of phosphates at 1 Anna per lb.	0	3	0
Other matters	0	1	6
Total value of excreta, per head, per annum ..	2	8	6

The values, put upon the fertilizing matters, are the prices which similar manural constituents sell for, in portable manures, in this Presidency.

Liquid excreta never collected.

9. No attempts have been made in this country to collect the liquid excreta of man hence, for all practical purposes, its value must be left out in our calculations. From the extracts given, it appears that human urine, in Europe, furnishes five-sixths of the ammonia generated on the decomposition of mixed excreta, and about three-fourths of the phosphates. We must therefore deduct from Rupees 2-8-6, the value of five-sixths of the ammonia and three-fourths of the phosphates of the mixed excreta, which together, amounts to Rupees 2-0-3, leaving Annas 8, Pies 3 or, say, in round numbers, 8 Annas, per head, as the value, in one year, of the solid excreta of one person.

In rural localities no difficulty in utilizing excreta.

10. In rural districts, the utilization of solid human excreta is attended with but few difficulties, from the readiness with which it can be mixed with earth and village ashes and, made into a compost, in which form the stuff readily becomes deodorized. The Ryots object, and with good reason, to collect and remove to their land the excreta of town populations, for setting aside all considerations relating to caste prejudices, the work is an exceedingly unpleasant employment, while the intrinsic value of the stuff is frequently very low, from natural poverty or admixture with useless matters.

11. If Municipal Corporations would get rid of the night-soil of their towns, by its utilization in agriculture as manure, they must convert it into a concentrated compound free from admixture with useless matters. There is no reason why poudrette should not be manufactured at, or, near many of our large towns. Manufactories for the preparation of poudrette have been established near many European towns, and the objectionable characteristics of such manufactories would not be greater in this country. Indeed, I think, that we have, in our dry atmosphere and high temperature, excepting during a small portion of the year, conditions highly favorable for the manufacture of poudrette, provided, always, that proper means are taken to check, or, keep back, the putrefactive processes which, in this country, operate so quickly.

Town excreta must be prepared for use in agriculture.

12. There are many different ways by which solid excreta can be converted into a portable manure, for instance, by admixture with dried clay, burnt clay, ashes, caustic lime, sulphate of iron, gypsum, animal charcoal, &c. In China, it is worked up with clay into the form of bricks which, after being dried, are laid aside until required, when they are pulverized for application to the soil. Burnt clay is also used to some extent in Europe and also dried clay, the latter, is the material used in "Moule's Earth Closet System," but, clay, whether burnt or dried, must be used in considerable quantity in proportion to the bulk of the excreta, hence, the mixture will not bear the expense of distant carriage. Ashes, are well suited for admixture with excreta but, the large bulk of the compost is objectionable unless, the land to which it is to be applied is in close proximity. Caustic lime mixed with excreta prevents any unpleasant smell, and the mixture is an excellent manure, but, the lime should be added only when the excreta is in a fresh state or, the ammonia will be entirely driven off; there is certainly a loss of ammonia when the lime is added to the fresh excreta but, it is small. Where sulphate of iron can be obtained, at a price sufficiently low, it forms an excellent material for mixing with solid excreta. Powdered gypsum has been largely used in Europe for converting excreta into a portable manure. Animal charcoal, the refuse of sugar refineries is, perhaps, the best material that has ever been used for mixing with solid excreta, not only does it thoroughly deodorize the stuff but, it adds immensely to its manural value by the phosphates it contains. In some localities in this country, animal charcoal, the refuse of sugar refineries, can be purchased in considerable quantities, at a very reasonable cost; I recently had an offer of 600 tons at Rupees 35 per ton delivered in Madras, this charcoal, contained upwards of 50 per cent. of phosphate of lime; near the sugar refinery from which, the charcoal was offered, Rupees 25 per ton, would have been accepted, which is, a very low price, for a manure so rich in phosphates.

Animal charcoal a good material for admixture with excreta.

13. However, my present object is not to deal with that difficult problem, the utilization of the excreta of town populations; I desire only to point out that in rural districts on the plains, where there are no difficulties attending the utilization of this useful manure, it is entirely lost to agriculture.

14. On the Nilgiris, where much land is in the hands of Europeans, human excreta is highly valued. The Coonoor Municipality in 1874-75 realized Rupees 2,866 for nightsoil and sweepings, and in the next year they realized Rupees 3,150. Four-fifths of the last mentioned sum, Rupees 2,520, represents the amount realized for the solid excreta of Coonoor in one year, which is about Annas 13½ per head of population. This is, of course, a much higher return than would be obtainable elsewhere in the Presidency, manure being so costly on the hills, owing to the great demand and, the difficulty of obtaining it; while, something must also be attributed to the excreta possessing a somewhat higher fertilizing value than that of more poorly fed populations. Thomas Stanes, Esq., who has used nightsoil largely on his estates at Coonoor, informs me that he finds it to be an excellent manure. In dealing with this manure Mr. Stanes' usual practice is to make it into a compost with other manure, and to keep it in a heap for a year, or so, when it is found to be sufficiently decomposed and deodorized for distribution over the land.

High value of human excreta on the hills.

Method of using excreta.

15. At Ootacamund, the Municipality manufacture poudrette from a mixture of human excreta, sifted ashes, dried earth, blood and animal charcoal which, they sell readily, on the spot, at Rupees 7 per ton. The following shows the quantity of this poudrette made and, the amount realized for it, in each year, since the commencement of the manufacture;—

Poudrette.

	TONS	RS.
1867-68	.	170
1868-69	..	162
1869-70	..	186
1870-71	68½	469
1871-72	213	724
1872-73	220	870
1873-74	260	1,307
1874-75	210	1,423
1875-76	432	2,861

Mr. Stanes informs me that he uses this manure, to some extent, on his coffee estates; and that, he finds it a valuable manure, one cart-load producing as good an effect as four cart-loads of ordinary cattle manure.

16. *Slaughter-house Refuse.*—The refuse of slaughter-yards is, also, in this country, almost entirely wasted. It is difficult to obtain data, by which this loss to our agriculture can be ascertained. I possess statistics relating to Madras however which, will throw some light on the matter. In the City of Madras about 8,000 head of cattle, and, 220,000 sheep, are killed annually, in the Municipal slaughter-yards. The population, at the last Census, was 397,552 persons, of whom, probably, not more than 17,500 were total abstainers from animal food, leaving fully in round numbers 380,000 flesh-eaters.

17. The amount of butcher-meat consumed, per head of the population, is exceedingly small, due chiefly (as regards mutton) to the great poverty of the people. Under ordinary circumstances a pound of mutton, per day, suffices for the wants of a Hindu family of six persons; but, small as this consumption is, *at the least* 12 *sheep would be required in a year*, for such a family. By far the largest number of the inhabitants of Madras who would gladly eat mutton, purchase it only on ceremonious and other special occasions, as a luxury.

Small consumption of meat, due to poverty.

18. From experiments, I have made, I find that, a bullock of about 500 lbs. live weight, in a condition somewhat better than that of cattle when slaughtered for food in this country, will yield about 42 per cent. of saleable meat, the offal, thus being about 58 per cent. of the live weight; this is a much higher percentage than the offal forms of oxen in England, thus Mr. Laws, F.R.S., in his well-known paper on the composition of oxen and sheep, shows that the mean percentage of offal in 16 bullocks was only 38·85 per cent.

Offal of oxen.

19. Assuming that, the average live-weight of a bullock, when slaughtered in Madras is 500 pounds, per head, and that, the offal weighs 58 per cent. of the live weight, the offal of one bullock will weigh 290 pounds, from this 290 pounds, we must deduct about 60 pounds, the weight of the portions of the offal, hide, hoof, head, tongue, &c., that are utilized, and there remains 230 pounds, of which 20 pounds is blood, as the weight of the refuse matters, from one bullock.

20. Blood is, of course, the most valuable portion of the refuse, it has long been known to be a most powerful manure, its composition resembles very closely that of flesh. Blood contains about 80 per cent. of water and 20 per cent. of solid matter, rich in nitrogen. Fully one-half of the ash of dry blood consists of common salt, the remainder of the ash is, chiefly phosphate of soda and phosphate of lime; but as the ash constitutes only about 5 per cent. of the dry matter of blood, it does not possess much agricultural importance.

Blood valuable manure.

21. In England, fresh blood is occasionally used for mixing in a compost with ashes, generally at the rate of six gallons of blood to about one bushel of ashes; the blood is purchased, at from 3 Pence to 4 Pence a gallon; the compost after laying for a year in the heap, is thoroughly

Blood made into a compost.

deodorized and fit for use. On the Sydapet Experimental Farm, some of the blood and other refuse of the Commissariat slaughter-yards are utilized in the way just described, the manure after nine or ten months is found to be quite free from smell, and, in a dry powdery state.

Conversion of blood into manure.

22. The method usually followed in dealing with blood, is to dry it in a steam-cased vessel, in which, about 60 per cent. of the moisture is driven off. Professor Way, examined many samples of dry blood, the following are the results of three average samples :—

	Water.	Ammonia.
Sample 1	8·78	16·07
Do. 2	7·91	16·49
Do. 3	6·19	16·91

High manural value of dry blood.

It will be noticed that, the percentage of ammonia is very high, equal indeed to the amount found in ordinary Peruvian guano; blood is therefore of great value, as a manure for tea and sugar-cane plantations, for betel and plantain gardens, for cocoanut trees, &c.; sometimes blood is coagulated under the influence of heat, after which, it is broken down, mixed with charcoal gypsum, &c., and dried again, when, it is an excellent portable manure, and sells readily.

23. The fresh blood yielded by a bullock should be worth from 5 to 6 Annas. I fear that it is only as a *dry* manure, that blood could be utilized, in such a town as Madras, from the difficulty of transporting it to the land and the absence of local demand.

24. Estimating that the 20 pounds of liquid blood will yield 5 pounds of dried blood, containing 16 per cent. of ammonia, the blood of one bullock should be worth nearly 5 Annas, valuing the ammonia at 6 Annas per pound, but, of course, against this there is the cost of preparation.

Value of offal of one bullock.

25. The other refuse of the bullock, consisting of intestines, contents of stomachs, &c., will weigh about 210 pounds and, should be worth 7 Annas and 6 Pies, valuing it at 5 Rupees per ton, this 7 Annas and 6 Pies with 5 Annas for the dried blood, makes the total value of the refuse offal of one bullock Annas 12, Pies 6, or, in round numbers, Annas 12.

26. We thus find that the *whole* refuse of the cattle slaughtered at Madras should be worth, at the least, Rupees 6,000, of which Rupees 2,500, would be the value of the dried blood.

27. Excepting in the larger towns where Europeans and Eurasians reside, there are but few cattle slaughtered for food, and the loss of manural substances from this source cannot be otherwise than small, compared with that which results from the waste of the offal of sheep slaughtered for food.

Offal of sheep.

28. The offal of a sheep, killed when in the ordinary condition, weighs about 55 per cent. of the live-weight of the animal. In the Commissariat slaughter-yards at Sydapet, 409 sheep, which weighed 25,366 pounds live-weight, yielded 11,668 pounds of mutton, equal to 29 pounds of mutton per head, of 62 pounds live-weight, in this instance, the offal was about 54 per cent. of the live-weight. Mr. Laws, in his experiments, before referred to, found that, the skin, head, liver and other portions of the offal of a sheep, which are utilized; weighed about 14 per cent. of the live-weight, deducting this, we find that the refuse offal is, about 40 per cent. of the live-weight, of which the blood forms 4 per cent.

Sheep killed for food in Madras.

29. In the City of Madras, 220,000 sheep are killed in the year, estimating each of these to weigh 60 pounds live-weight and, that, the refuse offal is 40 per cent. of the live-weight, we find that, the weight of this refuse should amount to, in the year, 5,280,000 pounds, of which 528,000 pounds is blood. Valuing the refuse as before, the blood is worth 8,250 Rupees and, the other refuse Rupees 10,607-2-3 or, the entire refuse of the slaughter-yards in the year, assuming that none of the blood is utilized for food or other purposes, should be worth in round numbers twenty-five thousand rupees, less

the cost of drying the blood; and this refuse, should suffice to manure highly 2,000 acres of arable land every year.

30. The consumption of meat, in the City of Madras, would not, of course, be a fair standard, by which to gauge the consumption of meat over the whole Presidency, and thereby to determine the value of the refuse of animal slaughtered for food. I believe however that, the consumption of animal food in this Presidency, is very much greater than is usually supposed. If, we deduct from the population of the Presidency 1,095,445 Brahmins who, are the only total abstainers from flesh, excepting a small number of Hindu vegetarians, we find that, the flesh-eaters amount to about thirty millions. Even Brahmins, in some parts of India, eat flesh, as the following extract proves;—

* "Another peculiarity in the *âcharâ* of the Kâsmirian Brahmans is the universal consumption of meat. All eat mutton, goats' flesh, and fish. But they obey the usual restrictions of the Sâstras as to beef, pork, and the meat of other forbidden animals. They usually declare that the custom of eating meat is based on a dêsaguna, 'a virtue of the country,' and that they leave it off as soon as they descend into the plains. They also fully acknowledge the duty of *ahimsâ*, of preserving life, and themselves are by no means willing to kill anything. If told that their acts are not consistent with their professions, they answer that their abstaining from meat would not prevent the slaughter of animals, as the Mahommedans of the country would still require meat. There can be little doubt that the practice of eating meat has come down to the Kâsmirians from the most ancient times. It prevails to a much greater extent in Northern and Central India than is generally known. In the Punjab, the North-West Provinces, Rajputana, and in parts of Bengal all Siva Brahmins eat meat."

31. The Agricultural Statistics of this Presidency, do not show the number of sheep we possessed in any year, since the official year 1871-72, in that year our sheep stock was 6,745,000, while in the preceding Census, of 1869-70, the number of sheep was shown to be 6,196,000, we had, thus, an increase only amounting to 549,000 in the two years. Under the heading "sheep" goats are classed, and these, constitute at the least two-thirds of the number of animals classed as sheep. Assuming then, that, in the official year 1869-70, we possessed, in round numbers, four million goats and that one-third of these were she-goats in a breeding condition, they ought to have yielded, in the year, about two million kids. In the same way we may estimate that, one-third of the two millions one hundred and ninety-six thousand sheep, were breeding ewes, these, ought to have produced in the year, for each 100 at the least 75 lambs, or, 549,000 lambs. The increase of stock would thus be, say, in round numbers, two millions of kids and, half a million of lambs, total $2\frac{1}{2}$ millions. Assuming that, in the following year the increase of stock was the same, and it was likely to be much greater from additional ewes and goats beginning to breed, the increase would represent altogether five millions which, with the stock on hand 1869-70, 6,196,000, should make the sheep-stock in 1871-72, 11,196,000 provided there were no deaths. Putting the death by disease, &c., at 10 per cent. per annum we should have had in 1871-72; 9,293,760 goats and sheep, whereas, we had only 6,745,000, showing a loss of two and a half millions which, I suppose *represents the number of animals that were slaughtered in the year for human food*, the refuse offal of which must represent a very considerable sum, if that of 220,000 sheep is worth as I have already shown Rupees 18,000.

32. *Carcases of diseased Animals.*—But besides the diminution of stock by slaughter there is annually an enormous loss by disease and from natural causes, the aggregate of which will represent an enormous quantity of manural matters that, under present arrangements, are almost entirely wasted.

Death of cattle by disease.

33. Few persons, are aware of the great loss of cattle, by death, during a year in this Presidency. From the Board of Revenue's Administration Report for 1873-74 and 1874-75, I learn that, the number of cattle reported to have died during these official years, was 507,303 and, 710,153; and during the past year, in many localities, 75 per cent. of the

* From a report by Dr. Bühler published in the Journal of the Bombay Branch of the Royal Asiatic Society for 1877, at page 23.

cattle are said to have died. The carcases of animals that have died are never utilized as manure, excepting, on coffee estates; of late a trade has sprung up in bones but, they are collected chiefly for export. It has already been shown that the refuse obtained, when a bullock is slaughtered for human food, is worth, as manure, under average circumstances, Annas 12; the remainder of the carcass, consisting of the flesh and bones, should be worth at the least Rupees 1-2-0, making the total manural value of a bullock of 500 pounds live-weight, Rupees 1-14-0, however, the cattle of the Presidency will not average, in live-weight, more than two-thirds of this weight, to arrive then, at the manural value of one such animal, we must deduct one-third from Rupees 1-14-0 which will leave Rupees 1-4-0 as, the manural value of the carcass of an ordinary cow, or bullock.

Carcases of diseased animals not utilized.

34. It is evident from the Custom House Returns of this Presidency showing the number of hides and skins exported annually that the death-rate of Farm Stock of all kinds, from slaughter, disease, and other causes, is vastly greater than is usually supposed, thus;—

Hides of Cattle and Skins of Sheep exported.

District from whose Ports the Hides and Skins were exported.	Hides.						Skins.					
	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.	Total.	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.	Total.
Madura	..	..	..	2	..	2	50	365	..	121	4,090	4,626
Malabar	37,664	30,587	52,909	79,983	347,921	549,064	11,392	17,153	12,678	14,294	19,915	75,432
Pakala, Nellore	..	..	..	..	..	..	40	..	..	..	94	134
Madras	164,469	15,544	389,995	432,059	473,326	1,475,393	6,166,859	7,600,834	9,383,314	8,128,749	6,519,491	37,799,247
Cuddalore, South Arcot	..	100	233	..	..	333	520	13,211	1,483	4,940	2,000	22,154
Vizagapatam	158,690	104,253	267,622	173,393	157,034	860,992	141,703	111,495	216,689	160,162	142,100	772,149
Tanjore	..	190	200	50	35	475	1,328	1,700	1,080	2,482	4,495	11,085
Mangalore, South Canara	24,139	24,706	26,759	31,659	31,263	138,526	10,390	1,399	9,974	3,490	2,252	27,505
Godavery	19,851	23,556	96,385	88,165	43,524	271,481	319,637	349,901	309,385	304,907	266,804	1,550,634
Tinnevelly	3,847	3,908	5,089½	17,126	14,637½	44,608	54,906	84,573	67,959	72,547	87,067	367,052
Ganjam	97,570	48,019	120,660	91,178	93,811	451,238	16,657	9,217	17,552	17,369	24,649	85,444
Kistna	3,614	6,102	8,320	8,385	17,222	43,643	..	3,556	8,424	12,526	60,938	85,444
Total ..	509,844	256,965	968,172½	922,000	1,178,773½	3,835,755	6,723,482	8,193,404	10,028,538	8,721,587	7,133,895	40,800,906

Agricultural statistics inaccurate.

35. In this statement it is very probable that some hides and skins have been twice brought to account from their having been shipped to Madras and again reshipped there for export; but, this inaccuracy cannot influence much, the conclusions which must arise from fairly weighing the evidence the statement affords. It will be observed that in one year 1872-73, 10,028,538 sheep skins were exported whereas, the agricultural statistics show that the sheep-stock of this Presidency about that time, amounted only to about 6,745,000. As a sheep-skin can but represent the death of one sheep, it is evident that the agricultural statistics must, as regards sheep, be very inaccurate, for if the whole of the sheep-skins from the minor ports of the Eastern Coast had been shipped to Madras, which, of course, is highly improbable, they would not have added more than about half a million to those delivered in Madras by land. Of course, a number of hides and skins are taken to Madras from Mysore and Hyderabad by railway but, on account of the expensive carriage, it is not probable that this occurs to any great extent.

36. There is thus available to the Agriculturist a large quantity of valuable manural matter which he altogether neglects. I have, in the foregoing, shown the money-value of some of these refuse substances; it may be objected that the prices are higher than could generally be obtained; this, I admit to be true as regards the present time; but, if agriculture was practised as it should be, the prices I have set upon these refuse matters would be fully realized. However, I do not press the views expressed regarding this part of the subject. Whatever may be thought of the money values arrived at, there cannot be two opinions regarding the manural value of the substances.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms.

29th September 1877.

APPENDICES.

APPENDICES

TO

THE SYDAPET EXPERIMENTAL FARM REPORT.

RECEIPTS OF THE SYDAPET EXPERIMENTAL FARM DURING 1867-77.

Experimental Farm.

	Rs.	A.	P.	Rs.	A.
Fruits, vegetables, &c.	618	8	0		
Fodder, &c.	115	14	11		
Rent, &c.	364	15	0		
Cattle	66	9	0		
Sheep	94	14	9		
Pigs	15	12	4		
Poultry, &c.	257	6	2		
Feeding grains	525	15	6		
Cotton	178	8	6		
Machines	106	7	6		
Indigo	85	6	2		
Seeds	147	14	2		
Sundries	181	3	5		
				2,759	7 5

Implement Workshops.

Machines, &c.	915	13	0		
Labor materials, &c.	1,423	14	2		
				2,339	11 2
Total ...				5,099	2 7

VALUATION OF THE SYDAPET EXPERIMENTAL FARM ESTATE, BUILDINGS, &c., AND OF THE LIVE AND DEAD STOCK OF THE FARM, ON THE 31ST OF MARCH 1877.

	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Land—									
50 acres of land at Rupees 200 per acre	10,000	0	0						
130 do. at do. 140 do.	18,200	0	0						
100 do. at do. 70 do.	7,000	0	0						
Roshumbaukum Village-site	680	0	0						
				35,880	0	0			
Buildings—									
Superintendent's, Overseer's, Students' quarters with out-buildings.	10,000	0	0						
Granary; Barn Cart Sheep and Implement Sheds, and other Farm buildings.	9,800	0	0						
				19,800	0	0			
Wells (23) and channels	.....			3,600	0	0			
Fruit and other trees	.....			4,705	0	0			
							63,985	0	0
LIVE STOCK—									
Cattle	3,980	0	0						
Sheep	1,380	0	0						
Pigs	100	0	0						
Poultry	171	0	0						
				5,631	0	0			
DEAD STOCK—									
Seeds and Grains	494	9	0						
Manures	553	8	0						
Implements	6,617	13	0						
				7,665	14	0			
GROWING CROPS	.....			672	12	0			
							13,969	10	0
Total ...	.....			.....			77,954	10	0

APPENDICES

TO

THE AGRICULTURAL COLLEGE REPORT.

EXAMINATION REGULATIONS.

I. No student will be allowed to quit the Examination Room until the expiration of half an hour from the time fixed for the commencement of the examination, and a student arriving after the expiration of that half hour will not be admitted.

II. No student will be allowed to re-enter the Examination Room during the examination, after once quitting it, nor to leave the room without finally giving up his answer papers.

III. Any student detected in speaking to, or in any way communicating with, any other student, will be at once removed from the room, and the circumstances reported to the Superintendent, Government Farms.

IV. *No student will on any account be allowed to take into the Examination Room, books or papers of any kind.* Any one detected with such in his possession, or having recourse to any unfair practices, will be removed from the room and the occurrence reported to the Superintendent of Government Farms.

V. A student having completed his paper will rise from his seat and remain standing until the First Master takes his answer papers. Any student wishing to ask any question will pursue the same course but will on no account leave his place.

VI. Each page must be marked with the student's name, and his register number, and each page must be numbered in consecutive order. Any paper sent up without the student's name and number affixed will not be examined.

VII. Students will not be allowed to take any papers, except their question papers out of the Examination Room.

VIII. Students are forbidden to tear up papers or to throw papers on the floor. All "spoilt copies, &c.," should be left on the desk where the student has been writing.

EXAMINATION QUESTION PAPERS.

WINTER SESSION, 1876-77.

AGRICULTURE.

Examination—January 27th, 1877.

I. What are the uses of Farm Fences?

II. State what crops are growing in fields $\frac{B}{4}$ and $\frac{A}{14}$.

III. Why are the soils of the Farm unsuited for growing Tobacco?

IV. State some reasons why Indian Agriculture should be improved.

V. Explain in what way land under crop is benefited by being hoed.

VI. Mention the names of the different parts of an iron plough.

VII. State what work was performed yesterday in fields $\frac{B.}{10}$ and $\frac{B}{8}$.

VIII. What kind of oil-cake is given to the sheep, and about what quantity is allowed for each full-grown sheep?

IX. State generally in what way a soil is benefited by deep tillage.

X. What crops are now growing in fields $\frac{A}{11}$ and $\frac{C}{16}$?

VETERINARY.

Examination—February 3rd, 1877.

I. How are living bodies distinguished from inanimate (or mineral) substances?

II. What organs are contained in the abdomen; and what kind of membrane lines the cavity?

III. Name the openings into the fauces.

IV. When the food is swallowed, where does it go, and what prevents it from going into the trachea (or windpipe)?

V. How are arteries to be distinguished from veins; arterial blood from veinous blood, and what is the reason of the latter difference?

VI. In what respects does white fibrous tissue differ from yellow fibrous tissue?

VII. What is the microscopic structure of a voluntary muscle?

VIII. How many varieties of Epithelium are there, and what are they?

IX. What gives the blood its red colour?

X. Where the ends of two bones are brought together to form a free moving joint, how are they kept in opposition, and what provision is there to prevent friction?

CHEMISTRY.

Examination—February 10th, 1877.

I. What is a simple, and what a compound, body? Give examples. How many elementary bodies are there, and how are they classed?

II. What is meant by the *physical* and the *chemical* properties of a substance?

III. Give the meaning of the terms Cohesion and Chemical affinity.

IV. Define weight. What is the metric system of weights and measures based upon?

V. What is the unit of weight and of capacity in the metric system, and give the equivalents in English measure?

VI. Define Specific Gravity.

VII. You are required to shew how the specific gravity of a sample of milk is determined.

ARITHMETIC.

Examination—February 12th, 1877.

I. From the definition of a decimal fraction, shew that

$$\cdot 7256 = \frac{7256}{10000}.$$

II. Express as decimals $\frac{2^4}{10^7}$ and $\frac{3^5}{10^8}$, and the sum, and the product of the quantities.

III. Simplify:—

$$\frac{\cdot 1\times\cdot 1\times\cdot 1+\cdot 01\times\cdot 01\times\cdot 01}{\cdot 2\times\cdot 2\times\cdot 2+\cdot 02\times\cdot 02\times\cdot 02}.$$

IV. A man in mowing grass walks at the rate of ·4 miles an hour; it takes him 72 minutes to mow a grass plot of 1,056 square yards. How broad does he mow?

V. It is agreed that the rent of a farm shall consist of a fixed sum together with the value of a certain quantity of rice. When rice sells at 8 measures a rupee the rent is Rs. 250; and Rs. 280 when rice is 5 measures a Rupee. What will the rent be when rice sells at 6 measures a Rupee?

BOTANY.

Examination—February 17th, 1877.

I. Mention the parts of a flower and state which of these are essential and which non-essential.

II. Give the meaning of the terms acaulis, haulm, achlamydeous, monodelphous, culm, stipe, caudex and claw?

III. Describe a Phyllodium. How does it differ from the blade of a leaf?

IV. Give the names of the different kinds of underground stems, and mention examples.

V. Name the different parts of a fruit. For example, the pod of the common pea.

VI. Mention and describe briefly the different varieties of roots.

VII. Give a sketch of the following kinds of leaves:—

1. Entire.
2. Penninerved.
3. Curvinerved.
4. Palminerved.

VIII. How does a root differ from a stem?

IX. What are the various parts of a seed? For example, that of the Castor-oil plant.

X. What is the leaf arrangement to which the terms opposite decussate, whorled, geminate and fasciculate apply?

MENSURATION.

Examination—February 22nd, 1877.

I. Define a Straight line.

II. Define a Rhombus.

III. Define a Parallelogram.

IV. Define a Surface.

V. Define an Angle.

VI. Define a Trapezium.

VII. Construct a scale 8 feet equal to an inch.

VIII. On what principle is the Plummet level constructed?

IX. What is a Radius?

X. How would you find the breadth of a river without crossing it?

ZOOLOGY.

Examination—February 24th, 1877.

I. Classify the following animals:—

Monkey.	Mouse.	Tiger.	Tapir.	Narwhal.
Elephant.	Sperm Whale.	Bear.	Hippopotamus.	Manatee.
Camel.	Kangaroo.	Sheep.	Rhinoceros.	Mole.
Horse.	Rabbit.	Llama.	Sloth.	

II. Describe the stomach of a ruminant and the process of rumination.
III. How are quadrumana popularly divided?
IV. Show how the order *ungulata* is sub-divided.
V. Describe the teeth of a rodent.
VI. Describe the leg of a ruminant.
VII. How is the order Carnivora sub-divided?

AGRICULTURE.

Examination—March 3rd, 1877.

I. Name the mineral substances found in a fertile soil.
II. Mention the general properties of a clay loam.
III. Under what conditions would it be unwise to plough a soil deeply?
IV. What proportions of sand, clay, and lime are found in the following soils:—
A sandy loam.
A marly soil.
V. How are soils formed from rocks?
VI. What are the characteristics of an alluvial soil?
VII. What was done with the flax crop grown on the Experimental Farm after it was removed from the field, and with what object?
VIII. How would you improve a sandy soil that parted too readily with moisture?
IX. Whence is the Potash in a soil derived?
X. What would be the character of a soil formed by the disintegration of a quartz rock?

ARITHMETIC.

Examination—March 6th, 1877.

I. Divide 30 by 3·14159 to three places of decimals.
II. Convert the following fractions into decimals:—

$$\frac{1}{7}, \frac{6}{7}, \frac{79}{99999}, \frac{79}{99900}, 23\frac{52}{333} \text{ \& } \frac{4111}{33300}.$$

Explain why the above fractions cannot be expressed as finite decimals.
III. A country plough can plough a field in 5 days, an English plough can do the same work in three days; how long will it take them to do the work together?
IV. In the Centigrade Thermometer the freezing point is zero and the boiling point is 100°; in Fahrenheit's the freezing point is 32° and the boiling point is 212°; what degree C corresponds to 68° F.?
V. If the produce of a certain cereal crop be 20 times the seed, how many loads can be obtained from an ollock of seed after 5 crops have been raised?

8 Ollocks = One Measure.
8 Measures = One Markal.
42 Markals = One Load.

VI. When engaged in working the water-lift which waters the Carolina paddy, the bullocks walk at a uniform pace of 2 miles per hour round a circle whose circumference is 60 feet. Every circuit turns up 7 buckets, the contents of which are emptied in succession into the water course. Each bucket measures 1 ft. 5 inches long, 10 inches broad and $7\frac{1}{2}$ inches deep. Find how much water is raised in a day of 8 working hours.

VETERINARY.

Examination—March 10th, 1877.

I. Describe the greater or Systemic circulation, noting the peculiarity of the portal portion.
II. What is the object of the Pulmonary circulation?
III. What are the differences between air expired from the lungs, and that of the atmosphere?
IV. What membranes cover the lungs, thoracic cavity and heart-sac (pericardium), and what line the pericardium, thoracic cavity, trachea and bronchial tubes?
V. How is the venous blood brought into contact with the air taken into the lungs?
VI. Is the diaphragm an inspiratory or an expiratory muscle?
VII. What is the difference between a true and a false rib?
VIII. What is "Coughing," and what causes it?
IX. What substances are found in the Blood?
X. What are the four varieties of food, and of what Chemical elements do they consist?

CHEMISTRY.

Examination—March 17th, 1877.

I. Define Temperature. What essential difference is there between the temperature of a body and the quantity of heat it contains?
II. Show how to graduate a common Mercurial Thermometer. What are the scales used? Give the freezing and boiling points on each.

III. The average maximum temperature in Madras during the past month has been 87° 6′ F.; and the greatest cold experienced by the Arctic voyagers in the late expedition was 102° F. below freezing point. What numbers in the Centigrade Scale correspond to these degrees respectively?

IV. What is meant by Latent Heat? If a piece of ice be put in a saucepan on the fire and kept there, what are the effects on a thermometer placed in the saucepan?

V. What are the three ways in which heat can be transferred from one place to another? Give examples.

VI. Give the meaning of the following:—

Atom; Molecule; Crith; Equivalent; Molecular weight?

VII. Give two of the more useful processes for preparing Hydrogen, and explain the chemical changes which result by symbols.

VIII. What weight of Hydrogen will 77 Grammes of zinc liberate from dilute hydric sulphate?

IX. State the properties of Hydrogen, and quote and explain experiments shown to illustrate its lightness and its inflammability.

X. Why is a mixture of Hydrogen and air explosive?

BOTANY.

Examination—March 24th, 1877.

I. What is a pitcher? State the views as regards its formation.

II. What terms are used to signify the various arrangements in the bud of the floral and foliage leaves? and define them.

III. When are stems said to be

(*a.*) Ascending.
(*b.*) Prostrate.
(*c.*) Creeping.
(*d.*) Climbing.
(*e.*) Twining.

IV. Describe a leaf-bud.

V. Give the characters of the following kinds of inflorescence:—

Corymb.
Compound umbel.
Raceme.
Cone.
Catkin.

VI. What are the distinguishing characters of a tree, shrub and under-shrub?

MENSURATION.

Examination—April 4th, 1877.

I. How many cart-loads of gravel will be required for a carriage-drive 200 yards long and 16 feet wide, the gravel to be spread 4 inches in thickness? (A cart-load = ½ a cubic yard.)

II. Required the number of Casuarina trees to plant an acre, the trees to be planted 3 feet part in the rows and the rows to be 4 feet from each other.

III. Calculate the amount of earth in an embankment 300 feet long, 30 feet high, 50 feet wide at the bottom and 15 feet wide at the top.

IV. Shew what area of land the earth in the embankment (see previous question) would cover, if removed and spread uniformly to a thickness of 7 inches.

V. Find the cubical contents of a teak beam 20 feet long, 12 inches thick, and 9 inches broad.

VI. Find the value of the teak beam (see previous question) at 80 Rupees per ton of 50 cubic feet.

VII. How many paving tiles, each 6 inches by 9 inches, would be required to pave a yard 28 feet in length by 19 feet wide?

VIII. Write down the number of square yards in a cawnie, in an acre, and in a ground.

IX. How could you continue the measurement of a straight line, when impeded by an object obstructing the sight.

X. How many squares of plastering are there in a room 15 feet long, 12 feet wide, and 10 feet high, deducting one door 6 feet by 5 feet and two windows 3 feet by 2 feet each?

AGRICULTURE.

Sessional Examination—March 26th, 1877.

I. State what you observed during the last cropping season, regarding the effects of deep tillage, on the Farm.

II. What information does a mechanical analysis of a soil afford?

III. What are the properties of a stiff clay, and what are the means by which such a soil could be improved?

IV. Describe briefly the principal varieties of soils found on the Farm, and indicate generally the portions of the Farm where each variety predominates.

V. If a country plough costs Rupees 3, and an English plough costs Rupees 18, explain in what way a ryot can be benefited by using an English plough.

VI. What advantages are secured by sowing seed by means of seed-drills?

VII. Give the general results of the Sorghum crop recently produced in field —— and of the Cholum crops recently produced in fields ——, ——, ——, and ——.

VIII. How are soils usually classified?

IX. What mineral matters do plants remove from the soil?

X. Name some serious defects in the agricultural practice of Southern India.

VETERINARY.

Sessional Examination—March 27th, 1877.

I. Why are animals warm?
II. What are the various tissues to be found in the leg of an animal?
III. What is the use of the arch of the vertebræ?
IV. What are tendons and ligaments, their uses, and of what tissues are they composed?
V. Which of the component parts of the blood are found in the serum?
VI. How do the bicuspid and tricuspid valves prevent the flow of the blood from the ventricles to the auricles?
VII. The capillaries which convey blood to the tissues being closed tubes, how do the tissues get their nutriment from the blood?
VIII. How is Expiration effected.
IX. What is the Alimentary canal?
X. What is Saliva; what its composition and uses, and how does it get into the mouth?

CHEMISTRY.

Sessional Examination—March 28th, 1877.

I. State the number of milligrams contained in 7·5 cubic centimeters of water at 0° C.
II. Equal volumes of Benzol and Glycerin weigh 102 and 147 grams respectively, and the specific gravity of the Benzol is 0·850; what is the specific gravity of the Glycerin?
III. Describe the method of taking the specific gravity of a light substance like wood.
IV. Write a description of the process of distillation by means of the apparatus known as Liebig's Condenser.
V. How is cane-juice converted into the solid substance—brown sugar? What circumstances would quicken the process of conversion?
VI. State briefly the law of gaseous volumes. Is there any difference between the molecular volume of Chlorine (Cl) and of the vapour of Acetic acid ($C_2 H_4 O_2$)—the former a simple, and the latter a compound gas?
VII. What do you understand by quantivalence of an element? Illustrate your meaning in the following list of elementary substances:—

H; O; Cl; C; Zn.

VIII. What is the action of a stream of dry Hydrogen gas on heated Magnetic Oxide of Iron ($Fe_3 O_4$) placed in a suitable apparatus? Give reaction.
IX. Supposing 27 grams of pure water are completely decomposed by the voltaic current, what volume will the liberated gases—collected separately over each pole—occupy at 0° C. and 760 m. m. pressure? What will their respective weights be?
X. Describe the process for preparing Oxygen gas with Potassium chlorate. Show and explain decomposition.
XI. How is oxygen distinguished from other colourless gases? What is combustion?
XII. Read the following formulæ, and state what the figures and symbols in each case express:—

$H_2 = 2$; $O_2 = 32$; $Cl = 71$; $H_2 O = 18$; $H Cl = 36·5$; $H_2 SO_4 = 98$.

BOTANY.

Sessional Examination—March 29th, 1877.

I. Give some important points of difference between plants and animals.
II. What does Economic botany relate to?
III. Describe characters, having reference to leaves and flowers only, which distinguish *Dicotyledons* from *Monocotyledons*.
IV. Describe shapes assumed by stems.
V. Give examples of tubers.
VI. Describe the two varieties of bulbs, viz., tunicated and scaly, and give examples of each.
VII. State what you know about a runner, an offset, and a sucker.
VIII. Mention examples of hollow stems.
IX. Mention and explain terms used to describe condition of the surface of stems.
X. To what description of stems would you apply the terms fruticose and suffruticose?

ZOOLOGY.

Sessional Examination—April 4th, 1877.

I. Describe briefly the order Cheiroptera, and fully the structure of the wing of a bat.
II. Explain the terms Perissodactyla, Artiodactyla, Omnivora, Ruminantia, and give instances of animals under each of these heads.
III. State the various grounds on which the class Mammals is separated from that of Birds.
IV. Classify the following birds: Owl, crow, kite, pigeon, and peacock.
V. Describe the sternum, coracoid bone, scapula, and furculum of birds.
VI. Name the birds that are useful to the agriculturist, and state how they are useful to him.
VII. In what respect do the Dugong and Manatee differ from Whales.
VIII. Name all those Mammals that prove troublesome to the farmer.
IX. Name all those Mammals which are useful to man.

ATTENDANCE MARKS REGULATIONS.

Marks for attendance will be awarded as follows :—

	Marks.
On the Farm, early morning	3
Lecture, morning	2
Class-room, afternoon	2
Lecture do.	2
Field-class in the evening	2

Students absent without leave will be debited with marks at the rate shown above. Students, who do not appear at the Reading-room and get their names marked on the roll, before 6-30 in the morning, will be considered absent without leave, and students who are not present at the roll-call at the time fixed for each Lecture, class-room gathering, Field-class, &c., will be considered absent without leave. Students absent with leave will have no marks deducted. At the end of the session one-third of the net marks obtained by each student will be added to the total marks he obtains at the examinations. Leave for absence from an examination will not be granted except, on the production of a medical certificate; and when ordinary leave is granted it must clearly be understood that the leave does not apply to absence from examinations.

EXAMINATIONS, AND FULL MARKS.

	Ordinary Examinations.	Marks.
January 27th	(*a*). Agriculture	100
February 3rd	(*a*). Veterinary	100
„ 10th	(*a*). Chemistry	100
„ 12th	(*c*). Arithmetic	100
„ 17th	(*a*). Botany	100
„ 22nd	(*c*). Mensuration	100
„ 24th	(*a*). Zoology	100
March 3rd	(*a*). Agriculture	100
„ 5th	(*c*). Arithmetic	100
„ 10th	(*a*). Veterinary	100
„ 15th	(*c*). Mensuration	100
„ 17th	(*a*). Chemistry	100
„ 24th	(*a*). Botany	100
	Sessional Examinations.	
March 26th	(*b*). Agriculture Paper	200
„ 26th	Do. Practical	100
„ 27th	(*b*). Veterinary	200
„ 28th	(*b*). Chemistry	200
„ 29th	(*b*). Botany	200
April 4th	(*b*). Zoology	200
	Total ...	2,400

Time allowed—Ordinary Examinations—1 hour.
Sessional do. 3 hours.

APPENDICES

TO

THE CAROLINA PADDY REPORT.

METEOROLOGY OF SOUTH CAROLINA FROM THE YEAR 1868 TO 1870.

Year and Month.	South Carolina.																							
	Aiken.				Gowdysville.				Fort Mill.				Camden.				Bluffton.				Holland's Store.			
	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.
January 1868	75	22	34·5	2·00	65	12	38·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	68	32	50·3	5·41	..	..	..	..	..	..	..	..	68	22	47·7	2·82	..	..	..	..	..	..	..	..
Do. 1870	77	23	49·1	2·86	66	18	47·1	4·45	..	..	..	..	..	..	..	..	78	32	56·1	3·70	66	20	47·2	5·70
February 1868	65	25	34·6	3·34	64	19	38·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	70	25	49·0	6·73	69	22	50·1	..	..	..	..	..	69	19	47·0	5·45	..	..	..	..	..	..	..	..
Do. 1870	70	15	46·6	2·77	68	16	44·1	4·45	..	..	..	..	..	..	..	..	76	32	53·8	2·20	68	16	46·0	6·98
March 1868	84	32	55·8	3·51	82	22	52·9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	75	25	53·3	2·58	77	20	53·3	2·58	..	..	..	..	74	16	51·5	2·36	..	..	..	..	..	..	..	..
Do. 1870	73	26	52·5	6·05	69	23	48·7	7·58	68	26	47·1	..	..	..	..	..	74	38	57·7	5·30	78	25	51·5	10·10
April 1868	87	39	57·0	9·34	83	35	58·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	84	34	62·9	5·05	88	28	59·2	2·21	..	..	..	..	84	34	62·4	1·69	..	..	..	..	..	..	..	..
Do. 1870	91	34	64·8	..	90	38	62·9	3·82	84	38	62·2	..	..	..	..	..	91	40	63·4	2·30	93	38	65·2	2·10
May 1868	87	56	69·8	6·42	89	50	68·8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	91	48	67·8	1·19	89	50	68·0	3·57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	91	60	72·9	1·92	90	53	76·3	3·65	90	52	70·3	..	..	..	..	..	92	60	74·3	2·70	..	..	..	..
June 1868	92	63	74·1	2·46	89	62	74·7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	94	64	77·4	3·72	91	65	77·8	4·25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	92	61	75·7	8·31	..	62	75·6	3·18	94	60	75·1	..	..	..	..	..	95	71	79·8	9·30	..	..	..	..
July 1868	99	71	79·4	..	97	72	82·1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	101	68	81·4	5·56	99	69	82·7	2·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	96	70	82·7	2·36	94	74	82·3	5·74	..	..	..	..	..	..	..	..	98	75	84·8	2·00	..	..	..	..
August 1868	90	65	76·2	6·40	90	65	77·6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869 ..	96	61	79·0	5·11	99	66	83·4	2·40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	96	62	79·8	6·00																				
Do. 1870	93	70	78·8	3·22	94	68	81·3	1·75	..	..	..	..	..	..	..	..	93	75	83·0	6·10	..	..	..	..
September 1868	87	50	73·1	4·04	89	50	72·8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869 ..	87	51	71·2	1·79	90	51	73·3	1·77	90	50	71·2	..	..	..	..	..	..	..	..	..	..	..	..	..
	88	54	71·0	3·00																				
Do. 1870	87	63	..	0·83	86	63	73·8	2·05	..	..	..	..	..	..	..	..	90	70	77·8	5·20	..	..	..	..

METEOROLOGY OF SOUTH CAROLINA FROM THE YEAR 1868 TO 1870—(*Continued*).

Year and Month.	South Carolina.																							
	Aiken.				Gowdysville.				Fort Mill.				Camden.				Bluffton.				Holland's Store.			
	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rain and Melted Snow.
October 1868	79	42	..	3·57	82	37	62·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	76	36	59·9	1·37	78	30	59·2	2·37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	80	49	65·3	4·40	..	..	..	..	..	..	..	..	..	..	..	..	86	56	71·6	8·40	..	..	..	..
November 1868	79	33	..	..	78	30	51·2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	71	30	47·4	2·76	67	27	47·5	3·85	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	78	29	52·7	2·11	70	27	52·1	2·50	..	..	..	..	..	..	..	..	86	39	60·9	4·20	..	..	..	..
December 1868	69	12	42·4	2·67	65	4	38·3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1869	67	30	47·1	4·58	68	22	43·6	6·97	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Do. 1870	75	10	43·7	1·53	69	7	41·6	5·10	..	..	..	..	..	..	..	..	68	18	48·4	5·20	..	..	..	..

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875.

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
Madras District.	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
January	30·122	29·844	·278	·120	29·977	87·2	61·4	25·8	84·6	67·3	17·3	74·9	68·7	73	134·1	61·6	·15	2	142	N. E. by E.	47	66
February	30·100	29·819	·281	·124	29·951	91·3	64·0	27·3	86·6	68·9	17·7	77·0	70·9	74	133·5	63·9	2·19	2	128	N. E. by E.	44	70
March	30·060	29·743	·317	·133	29·898	95·1	65·1	30·0	89·4	71·7	17·7	79·8	73·4	74	135·4	67·4	1·18	2	159	S. E. by E.	43	80
April	29·986	29·637	·350	·133	29·817	101·1	72·8	28·4	92·9	77·3	15·6	83·9	77·0	74	137·2	74·4	·95	1	198	S. E.	42	71
May	29·909	29·458	·451	·123	29·730	105·2	74·4	30·8	97·4	80·1	17·3	86·0	77·3	68	138·3	78·3	2·50	2	233	S. by E.	44	64
June	29·830	29·538	·292	·121	29·693	104·0	74·7	29·3	97·7	80·4	17·3	86·3	75·7	62	133·8	78·6	2·08	9	223	S. S. W.	39	34
July	29·846	29·565	·281	·122	29·717	102·4	74·3	28·1	96·1	78·6	17·5	84·7	74·3	64	132·7	76·6	4·35	14	211	S. W.	41	27
August	29·892	29·605	·287	·124	29·747	99·2	73·5	25·7	93·9	77·3	16·6	83·4	75·4	70	134·2	75·4	4·43	14	179	S. W. by S.	44	36
September	29·911	29·599	·312	·135	29·763	99·0	72·4	26·6	92·8	76·8	16·0	82·8	75·7	72	136·1	74·7	4·78	13	160	...	38	38
October	29·984	29·654	·330	·119	29·633	96·3	70·5	25·8	87·9	75·0	12·9	77·8	75·2	81	131·9	72·3	12·61	16	119	N. W. by N.	41	37
November	30·059	29·772	·287	·113	29·932	90·1	67·5	22·5	84·8	73·0	11·8	77·7	73·2	81	131·3	69·8	18·08	17	174	N. N. E.	52	37
December	30·099	29·823	·275	·114	29·976	87·1	63·9	23·1	83·7	70·4	13·3	75·8	70·7	78	133·1	66·1	4·92	8	169	N. E.	52	52
Kurnool District.																						
January	29·182	28·864	·317	·150	29·009	94·3	55·8	38·5	89·7	61·6	28·1	74·6	62·6	52	137·0	57·4	·36	1	107	S. E. by E.	25	82
February	29·148	28·785	·364	·158	28·949	100·6	61·3	39·3	95·2	66·9	28·7	80·2	64·4	43	145·5	62·9	...	...	111	S. E. by S.	20	85
March	29·047	28·697	·350	·159	28·856	107·6	64·3	43·3	101·8	72·2	29·6	86·0	66·0	35	152·3	68·2	·33	1	120	S. E. by S.	8	82
April	29·038	28·686	·352	·171	28·853	110·2	71·6	38·7	105·6	78·7	26·9	90·7	69·8	36	158·0	85·5	·35	2	165	S. by W.	36	69
May	28·978	28·618	·360	·163	29·048	109·7	72·6	37·2	103·6	78·6	25·0	88·9	72·5	47	153·7	77·3	3·44	7	234	S. W.	23	48
June	28·910	28·618	·292	·139	28·779	103·4	71·5	31·9	96·1	76·0	20·3	84·1	73·3	61	142·2	74·9	3·82	10	369	W. S. W.	27	27
July	28·929	28·646	·283	·125	28·800	97·8	71·1	26·7	91·3	73·7	17·6	80·6	72·5	68	136·3	72·5	6·64	13	340	W. by S.	28	19
August	28·991	28·682	·310	·141	28·829	97·4	70·5	26·9	91·8	73·7	18·0	81·2	72·3	66	139·6	72·3	3·32	9	313	W. by S.	33	28
September	29·006	28·681	·325	·149	28·852	94·6	69·5	25·1	89·5	73·0	16·5	79·6	72·9	74	140·6	71·4	8·65	13	259	West.	33	26
October	29·090	28·762	·327	·139	28·803	96·0	64·3	31·8	90·2	71·7	18·6	79·3	71·5	69	140·0	68·7	3·62	7	135	...	37	42
November	29·163	28·851	·312	·145	29·022	93·0	59·0	34·0	88·8	66·3	22·5	76·4	66·9	61	137·3	62·8	·84	3	132	E. S. E.	33	59
December	29·212	28·899	·313	·151	29·057	92·2	56·6	35·6	88·1	63·3	24·8	74·5	64·7	59	135·8	59·6	·69	3	112	E. by S.	29	69
Masulipatam (Kistna District).																						
January	30·148	29·845	·304	·126	29·987	86·7	61·1	25·6	82·7	65·4	17·4	73·8	67·9	74	142·5	59·5	1·67	2	155	E. N. E.	53	66
February	30·123	29·791	·332	·129	29·949	92·2	63·1	29·1	86·0	68·0	17·9	76·8	70·2	72	145·5	62·3	·84	2	76	E. S. E.	42	68
March	30·067	29·734	·333	·131	29·886	97·5	66·8	30·7	90·3	72·3	18·0	80·3	73·8	74	146·7	67·1	3·06	2	175	...	56	65
April	29·988	29·599	·389	·133	29·798	104·9	72·5	32·5	94·8	77·8	16·7	84·6	77·4	73	150·0	73·7	·25	1	...	South.	49	58
May	29·878	29·461	·417	·134	29·695	110·3	74·5	35·8	98·5	81·1	17·4	87·5	78·6	68	152·5	78·3	1·19	6	...	S. S. W.	48	48
June	29·782	29·486	·296	·122	29·635	104·7	74·1	30·6	96·1	80·6	15·5	86·4	77·2	67	144·7	78·5	4·39	13	...	S. W. by W.	44	30
July	29·792	29·503	·290	·116	29·653	100·4	73·9	26·5	91·7	77·6	14·1	83·1	76·0	73	137·2	75·3	6·59	20	21	W. by S.	50	26

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875—(*Continued*).

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
Masulipatam (*Kistna District*) —(Continued).																						
	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
August	29·854	29·555	·299	·121	29·694	98·0	73·3	24·7	91·7	77·9	13·8	83·4	76·6	74	142·5	74·7	5·90	15	21	W. by S.	47	32
September	29·885	29·538	·347	·130	29·723	95·5	73·8	21·6	89·7	77·3	12·5	82·2	76·8	79	144·2	74·2	7·34	16	20	West.	48	36
October	29·988	29·614	·374	·115	29·718	93·8	70·8	23·0	87·0	75·7	11·2	80·4	75·4	79	139·8	72·5	11·05	15	14	N. by E.	48	40
November	30·087	29·769	·318	·116	29·952	87·7	66·9	20·8	83·9	71·4	12·5	77·3	71·8	77	142·6	67·4	3·87	5	20	N. E.	51	54
December	30·139	29·855	·284	·124	29·996	85·1	61·2	23·8	82·5	67·5	15·0	74·7	69·2	76	141·3	62·9	·26	2	30	N. E. by E.	49	61
Coimbatore District.																						
January	28·731	28·454	·277	·148	28·581	91·1	57·1	34·0	86·1	62·9	23·2	73·3	63·0	57	135·0	58·2	·33	3	77	E. N. E.	42	65
February	28·715	28·613	·302	·161	28·561	95·1	60·0	35·1	90·2	65·9	24·4	76·8	65·0	54	138·5	57·6	·47	3	82	E. N. E.	38	67
March	28·692	28·392	·300	·162	28·531	100·1	60·8	39·3	95·4	68·9	26·5	80·7	67·9	53	144·4	64·8	·58	2	87	E. S. E.	37	66
April	28·638	28·289	·345	·162	28·475	100·3	68·9	31·4	96·4	72·8	23·6	82·5	71·8	60	142·9	69·6	2·28	6	96	...	44	47
May	28·587	28·279	·289	·128	28·441	98·3	68·6	29·7	92·4	72·8	19·6	80·2	72·2	69	135·8	70·0	2·43	9	144	S. S. W.	45	36
June	28·543	28·283	·260	·96	28·428	95·1	68·0	27·1	87·9	71·4	16·6	77·4	70·2	71	130·1	69·5	2·55	11	211	S. W.	50	20
July	28·544	28·332	·212	·91	28·449	91·1	67·8	23·3	86·8	70·3	16·5	76·1	69·7	74	131·1	68·4	1·35	9	223	S. W.	50	22
August	28·581	28·327	·254	·113	28·460	93·2	68·3	22·9	88·3	70·6	17·7	76·9	70·3	61	136·2	68·6	·78	5	196	S. W.	44	26
September	28·595	28·345	·251	·129	28·470	91·9	67·7	24·2	88·3	70·3	18·0	77·1	70·1	73	139·0	68·3	1·54	7	188	S. W.	41	29
October	28·645	28·350	·295	·140	28·489	93·1	66·4	26·7	87·6	70·1	17·5	76·3	70·7	77	138·5	68·5	6·10	12	96	...	36	24
November	28·700	28·396	·304	·140	28·561	90·5	63·4	27·1	85·1	68·7	16·3	75·4	68·7	73	134·6	66·3	5·18	10	76	E. N. E.	37	28
December	28·737	28·445	·291	·142	28·592	88·8	57·6	31·1	84·9	65·1	19·7	73·6	65·7	66	134·5	61·5	·47	3	81	E. N. E.	38	46
Madura District.																						
January	29·622	29·346	·276	·138	29·478	91·5	61·7	29·7	87·3	67·0	20·2	76·3	68·5	68	135·4	60·7	1·10	3	131	N. E. by E.	57	58
February	29·592	29·319	·272	·145	29·460	95·0	63·6	31·4	90·5	68·3	22·2	78·4	69·6	65	137·4	62·1	1·21	3	121	...	73	58
March	29·578	29·254	·324	·158	29·419	100·5	64·3	36·2	94·1	71·4	24·5	82·1	71·6	60	141·8	65·9	2·95	3	92	E. S. E.	31	62
April	29·493	29·201	·291	·147	29·358	101·8	69·9	31·9	97·9	75·2	22·7	84·4	74·6	63	141·8	70·6	3·57	4	78	S. E. by S.	47	51
May	29·447	29·149	·298	·146	29·304	103·9	71·3	32·6	98·8	76·2	22·6	84·8	74·6	63	140·1	71·0	3·24	4	81	...	37	49
June	29·408	29·140	·268	·121	29·284	103·1	73·0	30·1	96·9	76·5	20·4	84·2	73·7	61	138·6	72·6	2·90	3	119	West	32	40
July	29·429	29·184	·245	·116	29·306	101·5	72·0	29·6	97·2	75·9	21·2	83·6	72·9	60	139·4	72·1	2·22	3	106	W. N. W.	49	42
August	29·453	29·178	·275	·124	29·320	101·7	70·7	31·0	96·6	75·4	21·2	83·3	73·5	63	140·3	71·8	4·92	7	77	W. by N.	54	44
September	29·458	29·200	·258	·145	29·333	100·0	71·6	28·5	95·3	74·6	20·6	82·4	73·5	66	141·5	70·8	3·55	8	74	W. N. W.	64	45
October	29·517	29·222	·296	·131	29·453	97·7	70·2	27·5	91·4	73·2	18·1	80·0	73·7	75	137·5	70·2	9·03	13	59	N. W. by N.	72	42
November	29·575	29·275	·300	·133	29·444	93·3	68·7	24·6	87·3	72·2	15·1	78·3	72·9	78	134·3	68·6	6·68	9	102	E. N. E.	68	42
December	29·603	29·340	·263	·127	29·482	89·9	64·4	25·6	86·0	69·5	16·5	76·5	70·9	76	135·2	64·6	2·04	5	116	E. N. E.	65	53

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875—(*Continued*).

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
Bellary District.	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
January	28·653	28·338	·315	·148	28·482	94·5	55·0	39·3	88·9	60·3	28·6	72·8	60·1	48	135·3	56·2	·36	2	·77	E. S. E.	41	79
February	28·623	28·310	·292	·152	28·453	98·1	59·9	39·6	94·5	65·8	28·7	78·6	63·2	43	141·6	62·7	·04	1	98	S. S. W.	38	82
March	28·571	28·266	·325	·154	28·404	106·2	65·1	41·0	101·0	71·2	29·9	84·6	64·5	33	151·7	67·7	·34	1	118	S. by E.	34	79
April	28·515	28·191	·324	·157	28·342	108·2	71·0	37·3	104·1	76·8	27·3	88·6	68·5	37	157·0	74·3	·65	3	136	S. by W.	36	66
May	28·460	28·140	·319	·152	28·300	107·0	69·8	37·2	101·3	76·4	24·9	86·5	70·8	48	154·6	74·9	2·93	8	208	W. N. W.	43	45
June	28·396	28·104	·292	·121	28·268	104·0	70·8	33·2	94·7	75·0	19·7	82·4	71·3	59	146·6	73·6	2·47	8	237	W. S. W.	46	25
July	28·404	28·155	·249	·109	28·290	97·2	70·9	26·3	91·0	74·0	17·0	80·0	70·3	63	141·5	73·0	1·47	8	283	West.	46	18
August	28·445	28·171	·274	·125	28·312	97·7	69·7	28·1	92·7	73·0	19·6	80·6	70·2	61	145·5	71·9	1·68	8	275	W. by N.	42	30
September	28·475	28·176	·299	·137	28·330	95·4	68·9	26·6	90·0	72·4	17·6	79·1	70·5	67	143·4	63·4	4·08	13	228	W. N. W.	44	23
October	28·551	28·216	·335	·135	28·381	94·9	64·9	29·9	89·4	70·7	18·0	78·1	71·1	65	139·9	67·9	5·51	12	110	...	44	32
November	28·620	28·335	·285	·136	28·477	92·5	58·4	34·1	87·9	65·4	22·5	75·1	65·2	60	137·6	61·4	1·16	4	76	E. N. E.	47	49
December	28·655	28·359	·296	·141	28·503	91·4	54·3	37·1	87·3	61·8	25·4	72·8	62·4	57	132·0	57·3	·11	2	·75	E. by S.	51	62
Trichinopoly District.																						
January	29·851	29·546	·305	·148	29·574	91·0	60·8	28·3	86·9	66·5	20·4	75·3	67·7	68	136·2	61·0	1·06	3	153	N. E. by E.	33	65
February	29·817	29·522	·295	·148	29·672	95·3	63·5	31·9	90·8	68·7	22·0	78·3	67·7	65	138·5	63·0	2·64	4	130	E. N. E.	47	69
March	29·787	29·466	·321	·165	29·647	101·1	64·9	36·2	96·4	71·9	24·5	82·5	71·5	59	142·2	66·4	·07	1	121	S. E. by E.	32	76
April	29·716	29·362	·354	·157	29·552	104·2	72·2	32·0	98·9	77·3	21·6	86·0	74·9	60	143·0	74·0	1·50	3	144	...	...	45
May	29·688	29·332	·355	·146	29·515	106·4	74·0	32·3	100·6	78·5	22·1	87·3	75·1	57	140·3	76·0	2·39	5	198	W. by S.	...	45
June	29·603	29·299	·304	·122	29·465	102·1	74·8	27·3	97·2	78·3	18·9	85·4	73·6	57	135·0	76·7	1·79	6	356	West.	17	20
July	29·603	29·337	·265	·122	29·479	99·6	73·7	26·0	96·1	77·5	18·6	84·6	73·0	57	134·8	75·8	2·16	4	360	W. by N.	23	20
August	29·644	29·336	·308	·138	29·499	99·9	72·5	27·5	95·4	76·5	19·0	83·8	73·2	61	135·6	74·8	3·88	9	264	West.	26	21
September	29·655	29·350	·305	·153	29·512	98·5	72·1	26·5	94·0	75·8	18·2	82·9	73·3	64	136·6	73·9	5 14	9	243	W. by N.	28	21
October	29·703	29·397	·306	·142	29·546	95·5	69·5	26·1	89·5	73·5	16·0	79·9	73·7	75	134·5	71·3	6·05	15	125	N. W. by W.	31	22
November	29·767	29·480	·287	...	29·637	90·1	68·6	21·5	85·9	72·3	13·6	77·5	72·6	79	133·3	68·9	5·69	11	146	N. E. by N.	34	27
December	29·815	29·540	·275	·131	29·682	89·4	63·0	26·3	85·1	69·2	15·8	75·6	69·8	75	133·1	65·2	1·97	5	158	N. E. by N.	41	47
Negapatam (Tanjore District).																						
January	30·096	29·828	·268	·121	29·959	84·9	64·1	20·8	82·5	70·3	12·1	76·4	71·1	78	144·9	66·9	2·16	4	148	N. E.	84	64
February	30·078	29·804	·274	·127	29·941	86·9	66·2	20·7	84·4	72·1	12·3	78·1	72·2	75	143·6	68·8	2·74	3	110	East.	77	67
March	30·050	29·754	·296	·136	29·900	94·3	67·9	26·4	88·3	75·6	12·7	81·4	75·1	75	146·0	71·2	1·16	1	107	S. E. by E.	63	78
April	29·984	29·667	·318	·136	29·824	100·0	72·7	27·3	92·8	78·5	14·3	84·3	78·0	76	147·4	75·0	2·39	3	135	S. E. by S.	59	73
May	29·918	29·574	·344	·128	29·759	103·6	71·9	31·6	96·5	78·6	17·9	85·0	77·6	72	146·0	75·9	1·74	3	190	...	61	67
June	29·856	29·574	·282	·123	29·728	102·7	74·5	28·1	97·8	78·8	19·0	85·3	76·3	67	144·4	75·9	1·13	4	207	S. W.	71	57
July	29·871	29·601	·271	·125	29·750	101·6	74·0	27·6	97·2	78·0	19·2	84·2	75·5	67	144·9	75·5	2·05	6	201	S. W.	67	56

AVERAGE MONTHLY METEOROLOGICAL REGISTRATIONS FOR THE FIVE YEARS ENDING 1875—(*Continued*).

Months.	Barometer reduced to 32°.					Thermometer in Shade.								Relative Humidity.	Sun Maximum in Vacuo.	Maximum on Grass.	Rain.		Wind.		Ozone.	Clear Sky.
	Highest in Month.	Lowest in Month.	Range in Month.	Mean Daily Range.	Mean for Month.	Highest in Month.	Lowest in Month.	Range in Month.	Mean Maximum.	Mean Minimum.	Mean Daily Range.	Mean Dry Bulb.	Mean Wet Bulb.				Amount Collected.	No. of Rainy Days.	Mean Daily Velocity.	General Direction.		
Negapatam, (Tanjore District) —(Continued).	Inches.	Inches.	Inches	Inches	Inches.	°	°	°	°	°	°	°	°	Cents.	°	°	Inches	Days.	Miles.	Points.	Cents.	Cents.
August	29·736	29·635	·279	·129	29·776	99·2	74·1	25·1	94·7	77·3	17·4	83·1	76·0	72	144·3	74·6	3·69	7	158	S. W.	63	54
September	29·928	29·648	·279	·143	29·795	97·9	72·5	25·4	93·4	76·7	16·7	82·3	75·8	74	146·3	74·0	4·73	8	151	S. W.	64	52
October	29·990	29·672	·319	·132	29·824	95·8	71·8	24·0	89·4	75·5	13·8	80·7	75·7	80	142·1	73·3	7·36	15	112	S. W.	68	47
November	30·046	29·763	·283	·121	29·915	90·4	70·6	19·8	84·7	74·3	10·4	78·4	74·1	82	137·6	72·1	16·76	19	172	N. E. by N.	76	40
December	30·085	29·818	·266	·117	29·957	86·8	67·0	19·8	82·6	72·9	9·7	76·9	71·9	79	139·1	69·8	5·91	8	177	N. E.	73	50
Salem District.																						
January	29·205	28·906	·299	·155	29·040	91·3	58·3	33·0	87·2	64·7	22·4	75·2	66·1	62	144·1	57·3	·25	1	117	E. N. E.	57	80
February	29·177	28·870	·307	·162	29·017	97·9	60·9	37·0	93·0	66·8	26·2	78·8	67·9	57	145·8	61·4	·48	2	133	E. by N.	51	82
March	29·145	28·815	·330	·171	28·975	103·4	61·3	42·1	98·3	70·7	27·6	83·3	69·6	51	147·5	66·1	·50	2	128	S. E. by E.	40	82
April	29·086	28·734	·352	·172	28·912	104·2	69·9	34·3	100·0	75·4	24·6	85·7	73·0	56	157·4	71·5	3·13	7	108	S. S. E.	38	66
May	29·217	28·688	·329	·146	28·871	103·3	69·6	31·7	97·8	75·7	22·1	84·7	74·1	62	140·9	72·4	6·01	8	111	S. W.	37	56
June	28·980	28·681	·299	·124	28·854	100·0	71·0	28·9	94·7	74·4	20·3	82·4	73·3	66	136·9	71·6	2·36	9	129	S. W.	39	36
July	28·993	28·727	·266	·126	28·875	98·7	71·1	27·6	93·0	73·0	20·0	80·7	72·6	69	135·7	70·2	4·20	13	130	S. W. by W.	40	33
August	29·039	28·746	·293	·139	28·893	97·0	70·4	26·6	92·0	72·8	19·3	80·4	73·1	71	139·4	70·2	5·16	16	98	W. S. W.	37	36
September	29·039	28·753	·286	·150	28·903	95·6	69·8	25·8	85·5	72·4	19·0	80·4	73·1	72	141·9	69·3	6·36	12	96	W. S. W.	34	40
October	29·092	28·787	·305	·144	29·111	93·4	66·7	26·7	89·0	71·6	17·4	78·5	73·1	78	133·6	69·0	9·25	15	59	N. W. by W.	34	38
November	29·149	28·870	·279	·134	29·014	92·0	62·8	29·3	87·1	69·3	17·8	76·8	70·7	74	141·2	65·9	2·89	10	83	N. E. by E.	44	51
December	29·191	28·895	·295	·142	29·047	90·2	58·6	31·6	86·5	65·9	20·7	75·1	67·6	68	141·4	60·6	·78	4	100	E. N. E.	49	65

MADAGASCAR PADDY.

PROCEEDINGS of the BOARD OF REVENUE, dated 4th October 1877, No. 4,633.

Read the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Sydapet, 21st September 1877, No. 820:—

WHEN preparing my report on the Carolina paddy experiments of this Presidency, I had occasion to search through many American publications for information regarding the early history of that paddy, and while so engaged I frequently met with statements to the effect that the Carolina paddy is the descendant of paddy imported into America from Madagascar.

2. It being a matter of some importance, in connection with the improvement of the rice of this country, to determine whether Madagascar now possesses any varieties of paddy of a class so high as that from which the Carolina paddy must have originated, I obtained, through the kindness of the Reverend Mr. Organe of Madras, the address of the Reverend Mr. Toy, a Missionary residing in Madagascar, and I asked that gentleman to be good enough to procure and forward to Madras samples of the different varieties of paddy grown in Madagascar.

3. The samples of paddy have just reached me; they represent five varieties, but only one appears to merit special attention; it is that of the paddy known in Madagascar as Rojofotsy. I enclose a sample of this paddy and a sample of its rice. It will be noted that the grain is very large. For comparison I also enclose samples of Carolina paddy and rice.

4. On comparing the two varieties of paddy, it will be observed that the grain of the Madagascar variety is considerably the largest. I find that, while 846 grains of the former weigh one ounce, it requires 990 grains of the latter to make up the same weight. The Carolina paddy is a very good sample and quite as large in the grain as when first imported into this country. Had the Rojofotsy paddy been as well cultivated as the Carolina paddy, the grain would have looked much better; only a portion of it appears to have been properly matured. Both varieties of paddy contain an admixture of paddy that yields a red rice. It can scarcely be said that this proves their common origin, for it frequently happens that red rice is mixed with white rice. The red rice which is found in America amongst Carolina rice may have been as readily introduced into that country in Indian seeds as in Madagascar seed.

5. On comparing the rice of the two varieties of paddy, it will be observed that the Carolina rice is smaller, though whiter, plumper, and more starchey than that of the Rojofotsy paddy. From a small experiment I made, I found that, while the Carolina paddy yielded 79·79 per cent. of rice, the Rojofotsy yielded only 76·46 per cent. by weight. The lesser yield of rice from the Madagascar paddy was due, I think, to many of the grains being imperfect, for, as I have already noticed, the perfectly formed grain is heavier than the grain of Carolina paddy of equal quality. The two samples are not, of course, of equal commercial value for export purposes, but for local consumption I would consider the Madagascar rice is quite equal to the Carolina rice.

6. I possess no information regarding the habit of the plant that produces the Rojofotsy paddy. It is, of course, quite possible that the crop may be unsuited for introduction into this country from being long in reaching maturity, or for other reasons. It seems, however, desirable that further inquiries should be instituted.

7. It seems not improbable but that the Rojofotsy paddy may be the variety from which the Carolina paddy was descended. The color of its husk is certainly not that rich golden color which now is so characteristic of the Carolina paddy seed, but the color of the husk may have become gradually darker in America. However, after growing a crop of the Rojofotsy I will be better able to form an opinion on this matter.

8. If Madagascar cannot supply a variety of paddy suited for introduction into this country in view to its cultivation, that Island may perhaps be able to afford a supply of paddy which, at the present crisis, might prove highly acceptable as food in this country.

APPENDICES

TO

THE GENERAL REPORT.

EXPENDITURE OF THE MADRAS AGRICULTURAL DEPARTMENT.

	RS.	A.	P.	RS.	A.	P.
I. General Supervision—						
Establishment	18,628	5	2			
Travelling allowance	317	6	0			
Contingencies	740	4	1	19,685	15	3
II. Sydapet Experimental Farm—						
Establishment	1,772	10	1			
Cooly labor	4,752	9	8			
Implements and machines	1,317	2	2			
Live stock	742	4	0			
Seeds	637	15	0			
Food for live stock	1,809	12	2			
Manure	927	9	9			
Despatching seeds	279	2	8			
Contingencies	278	9	0	12,517	10	6
III. Implement Workshops—						
Carpenters, Smiths and Filer	875	5	1			
Cooly labor	191	5	7			
Machines, implements and materials	879	13	4	1,946	8	0
IV. Educational—						
Sydapet Farm Apprentices	1,146	10	8			
Books for Library	156	14	0			
Contingencies	52	12	0			
School of Agriculture—						
Masters, Clerk and other servants	1,225	2	9			
Draftsman	97	3	0			
Lecture fees	1,620	0	0			
Furniture	1,492	11	0			
Accommodation	769	14	3			
Contingencies	389	14	2	6,951	1	10
V. Estate improvements—						
Repairs to buildings	1,655	1	1			
Water-channels	1,119	8	2			
Tress and planting	74	6	6			
Levelling the surface of dry land to be brought under wet cultivation	228	11	0			
Contingencies	123	11	9			
Manufacture of drain pipes and subsoil drainage	704	0	7			
Brick and mortar bridges under main roads ...	100	13	9			
Repairs to bridges	100	4	8			
Constructing level road way through the nullah between the Experimental and Model Farms.	166	5	6			
Constructing weirs to protect river banks ...	91	11	6			
Retiling Cattle-sheds	192	8	10			
Levelling in plantation occupied by Wudders ...	101	2	0			
Repairs to roads	458	4	1			
Sinking wells	109	3	10			
Construction of implement sheds	502	5	3			
Do. of food-preparing sheds	243	14	4			
Do. of cattle food stores	401	12	0	6,373	12	10
VI. Other charges—						
Paid Public Works Workshops and Pier Toll by transfer	145	9	6			
Paid Commissariat Department for cattle by transfer	490	0	0			
Paid value of, and freight on 28 Swedish ploughs, and one seed microscope, by transfer.	910	6	3			
Paid Veterinary Surgeon W. S. Adams by transfer	798	11	4	2,344	11	1
Total ...				49,819	11	6

INCOME OF THE MADRAS AGRICULTURAL DEPARTMENT.

	Rs.	A.	P.	Rs.	A.	P.
Adjusted balance at the beginning of the year	2,09,344	8	6			
Provincial Grant	20,000	0	0			
Receipts from the Surplus Pound Fund during 1876-77	71,707	9	6	3,01,052	2	0
Madras Experimental Farm	2,759	7	5			
Implement Workshops	2,339	11	2			
				5,099	2	7
			Total ...	3,06,151	4	7
Balance in favor of the Department on the 1st of April 1877	2,56,331	9	1			

Proceedings of the Board of Revenue, dated 16th May 1878, No. 1,324.

THE report of the Superintendent of the Government Farms for the year 1876-77 will be forwarded for the consideration of Government.

2. The most important fact mentioned in the report is that the Agricultural College was opened in October 1876, and it is gratifying to learn that numerous applications for admission were received by the Superintendent from all parts of India, and in many instances from well-educated youths whose training in scientific agriculture may be expected to have considerable effect on the progress of agricultural improvement throughout the country.

3. A reference to the statement shows that twenty-seven agricultural students were under education in the winter session ending March 1877; and judging from the marks awarded, it would appear that many did well and some very well at the weekly examinations throughout the course.

4. It is also very satisfactory to know that persons engaged in agriculture are increasingly communicating with the farm authorities with a view to obtain practical information on matters appertaining to their particular pursuits. Mr. Robertson is encouraging such inquiries, and will doubtless give attention to the best means of making public the information collected and conveyed on these occasions in such manner that it may be as practically and extensively useful as possible.

5. On the farm itself the drought interfered with ordinary operations, but the advantages of deep ploughing were all the more clearly shown.

6. There is much useful information to be found in the report, and many suggestions which the Board hope may gradually find their way to the agriculturists of the country and be adopted by them. But it must be observed that there is a great deal both of information and advice—excellent in itself and of much practical import if appreciated—that would find fitting place in a manual of agriculture, but that is somewhat out of place in an annual report of the working of a department. The Board by no means think the very elements of agricultural science are so well known that their exposition and repetition are unnecessary; but this should be reserved for separate papers, or appendices that may be published in District Gazettes, &c., independently, and the annual report, in its body at least, should be confined to showing the operations and progress of the department for the year under notice. For example, paragraphs 10 to 29 discuss general questions of rotation and courses of crops. They state no results obtained on the farm. They are generally instructive, but are not descriptive of experiences as paragraphs 30, 31, &c., paragraphs 39, 40, &c., distinctly are. Such remarks should be omitted or very sparingly introduced in annual reports in future. How information of the sort can be best brought home to the classes who will benefit themselves and the State by applying it in practice is a question which must engage the Board's attention, but it is one which they will be in a better position to consider satisfactorily after the receipt of the orders of Government on the Proceedings relating to the question of agricultural education generally in this Presidency (*vide* Board's Proceedings, dated 13th December 1877, No. 5,223).

7. The Board consider carefully prepared statements of the particulars of the cultivation of certain areas with specified crops in the year to be very valuable, and that analyses of the results of such experiments are most fitting in the report of the year's work. Of course, the utmost attention should be paid to economical working in these experiments, not only on general considerations, but that the advantages of the system pursued and recommended may be as apparent as possible. It should not be lost sight of however in considering results, that in the circumstances of a Government Farm the net returns in particular cases cannot be made the test of the advantages or disadvantages of a system advocated on scientific principles. Private agriculturists will undoubtedly be able to work on the same principles at a very

much lower rate of expenditure than is obtainable, even with the most careful management, on a Government Farm, and the difference they may reasonably look to saving must be credited to the profit side before the net returns that may be expected in private enterprise can be fairly calculated.

8. The report of the year just ended will shortly be looked for, and it is hoped will give a favorable account of the progress of the institution of which the report under notice records the satisfactory commencement.

9. Some papers are printed with the annual report—on "the Carolina Paddy experiments in the Madras Presidency," "the growth of forage for live-stock," "the pernicious effects of the use of cattle-dung as fuel," &c. By placing the report on the Editor's table an opportunity will be given for the dissemination of the information they contain.

10. The classified financial information, the absence of which from the last report was noticed by the Secretary of State, is not to be found in this report either, but the Superintendent has been asked to report on the matter with reference to paragraph 2 of G.O., dated 2nd April 1878, No. 519.

(A true Copy and Extract.)

(Signed) J. STURROCK,
Acting Sub-Secretary.

ORDER THEREON, 23rd July 1878, No. 1,148.

THE Board forward the report of the Superintendent of Government Farms for 1876-77. This embraces an account of some of the year's operations on the Sydapet Farm, a report on the progress of the School of Agriculture opened in October 1876, and some papers on agricultural topics drawn up by the Superintendent himself or the farm officers.

2. A history of the various experiments made during the last 7 or 8 years in the cultivation of Carolina paddy is also appended, with notes on the habits and customs of this plant in America. These last have already been submitted to Government in a separate form, and the School of Agriculture having its place in the general report of the Director of Public Instruction will not be noticed here.

3. In the report on the season at Sydapet there is some instructive information as to the rainfall, which in any one month of the last seven years has but rarely approximated the average deduced from sixty years' observations at the Observatory, which is only about 3 miles distant.

4. In 1876 the rainfall seems to have been fairly sufficient until the second week of September, but its subsequent failure during the north-east monsoon was very marked and appears to have been altogether insufficient to admit of wet crops being raised. This being the chief cultivating season in the district in which the farm is situated, the methods of cultivation adopted on the latter were subjected to a crucial test. In the case of the crops reported on the result was highly gratifying, for deep cultivation and high manuring secured a fair outturn, and one that, with straw and grain at famine prices, was distinctly remunerative. How much this result was due to deep cultivation is demonstrated by the contrast worked out between the yield on the body of the fields and that on the head lands where the cultivation was shallower, though not more so than in the ordinary practice of the country.

Paragraph 39.

Paragraph 31.

5. The dry crops planted in October had a rainfall of about 5 inches on 12 or 14 days, while a crop sown in November had only 1·71 inches on 6 days, and another, put down in December, only ·16 inches on 3 days.

It is noteworthy that the yield of straw in the last two cases was on a par with that of the crops that received more rain, but that the grain outturn was small.

Deep cultivation is also reported to have secured very satisfactory growth in the case of the cotton and indigo crops, but the final results will not appear until next year's report

6. In the matter of special crops it is noted that of five carob trees which had been planted eleven years, one has at last fruited, and that it is believed that it is the only female plant. Grafting the seedlings of this tree from known male or female plants is accordingly recommended.

7. No mention is made of the buffalo grass which was favorably reported on last year. The results of further experience in its cultivation should be noticed in next report. The Government also hope that the proposed* experiment to induce New Orleans cotton to alter its bearing season will not be lost sight of.

* Paragraph 151, Report for 1875-76.

8. In paragraphs 77 to 85 are recorded the results of some topdressing experiments made with saltpetre and bone charcoal on land sown with yellow cholum, but the dry season is said to have been unfavorable to the use of the former. The gain directly traceable to its use was not sufficient to repay the outlay, but it is hoped that the soil was permanently improved to the benefit of future crops. Bone charcoal is believed to be useless as a topdressing when used by itself, but further experience seems needed to place the matter beyond doubt.

9. In last year's report it was stated that indifferent results had been obtained in growing ground-nuts, and it was suggested that this was due to a want of lime in the soils of the farm. This conjecture is now shown to have been correct, for a crop of ground-nuts manured with lime gave an abundant yield. The general use of this manure is however not recommended as its stimulating qualities render it of dangerous utility in the hands of the ignorant or shortsighted cultivator.

10. The stock breeding experiment has been delayed from several causes, but the flock of sheep kept on the farm has thriven well. The loss was exceptionally small, and this is attributed to the absence of the rank grasses that spring up with an abundant rainfall. The quality of wool improved, but the yield per head was less, though found to be fair for the weight of the sheep.

11. The Government note that the Board have called for a report in regard to the financial statement desired by the Secretary of State. In this the farm accounts should be kept distinct from those of the School of Agriculture.

12. The Board further remark that portions of the farm report are devoted to conveying advice on various topics which are not directly illustrated by reference to any particular operations on the farm. These remarks they consider would find a more appropriate place in a manual of agriculture, and in this view the Government concur. The preparation of such a manual is a work that may well engage the early attention of Mr. Robertson and his Assistants, and much of the requisite matter is to be found in the interesting papers which accompany the present report.

13. The report on the farm should deal only with its working, but should show clearly and in sufficient detail what was done and left undone—the total extent, the area under wet and dry cultivation, the extent of grazing lands, &c., &c., and the financial results. From the present report the Government are unable to gather how far lands were left uncultivated or crops lost, or how the stock was maintained, and desire that the Superintendent will, if possible, supply this information at once. The record of the experiments made in cultivation and with special crops is useful and interesting, and should of course be continued, but the plan on which the whole operations are being conducted, and how far it was successful or the reverse, should also be shown, as well as the extent to which the deeper cultivation had been rendered possible or aided by artificial raising of the soil.

The Government cannot expect that the farm should be directly profitable, being used for experiments which may or may not succeed, but they wish to make it really

beneficial, and believe that this end may best be secured by subjecting its entire practice to public criticism.

14. In connection with this point the Governor in Council learns with satisfaction that the Superintendent's correspondence on agricultural matters is increasing and that information is offered as well as sought. This fact and the numerous applications for admission to the School of Agriculture evidence a growing desire for an improved agriculture, which must be a source of well-founded satisfaction to the Superintendent and his Assistants, and is in a great measure the fruit of their zealous and intelligent efforts.

15. The Government consider that the papers contributed to this report by Messrs. Benson and Schiffmayer reflect much credit on those officers, and Mr. Robertson himself has done well in calling attention to some neglected manural substances, though the inference as to the high death-rate of farm stock drawn by him from the Customs House returns of exported hides and skins is based on incorrect premises, large consignments of both skins and hides being regularly sent down by rail from both Bengal and Bombay to this Presidency to be cured and exported, as the product of Madras tanneries.

16. The Superintendent will submit his report for 1877-78 with the least possible delay, and his annual report will in future be despatched to the Board of Revenue not later than the 30th June.

(True Extract.)

(Signed) C. G. MASTER,
Secretary to Government.

THE

ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT

OF THE

MADRAS PRESIDENCY,

FOR THE YEAR ENDING 31ST MARCH 1878.

MADRAS:
PRINTED BY R. HILL, AT THE GOVERNMENT PRESS.
1879.

OFFICE OF THE SUPERINTENDENT, GOVERNMENT FARMS,
SAIDAPET, *29th January* 1879.

No. 122.

From

W. R. ROBERTSON, ESQ., M.R.A.C.,
Superintendent, Government Farms,

To

J. STURROCK, ESQ.,
Acting Secretary to the Board of Revenue.

SIR,

I HAVE the honor to submit the Annual Report of this department for the year ending the 31st of March 1878.

2. The report of the Saidapet Experimental Farm was submitted on the 29th of August, and that of the School of Agriculture on the 26th of September last.

3. The instructions conveyed in G.O., No. 1,148, dated 23rd July 1878, were received too late for compliance therewith in the preparation of the Farm Report. I have, however, submitted separately the information called for in paragraph 13, both for the official year 1876-77 and for the last official year.

I have the honor to be,
Sir,
Your most obedient Servant,
W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

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THE

ANNUAL REPORT

OF THE

AGRICULTURAL DEPARTMENT

OF THE

MADRAS PRESIDENCY

FOR THE

YEAR ENDING 31ST MARCH 1878.

INTRODUCTORY.

THE difficulties, which in 1876 lay in the way of successful agricultural enterprise, were not, during the year under report, removed until late in the season; the south-west monsoon rains were deficient and those of north-east late, irregular, and below the average in the amount of rain precipitated.

No important extension of the work of the department was made during the year, but it has been proposed to institute throughout the whole Presidency numerous small educational and experimental stations, each to be individually under native managers, educated in the School of Agriculture and trained on the Experimental Farm at Saidapet; these stations being grouped together in circles under the supervision of European officers trained and educated in the practice and science of agriculture; this proposal met with the approval of the Board of Revenue in December 1877, but is still under the consideration of Government.

No tours were made in any part of the Presidency by any officer of the department; but the Superintendent of Government Farms was deputed in January to enquire into the causes of, and to suggest remedies for, the ravages, then being committed, near Trivellore in the Chingleput District, on the paddy crops by a caterpillar.

Owing to the character of the year no agricultural exhibition was held.

The School of Agriculture, which was opened in October 1876, was in full work during the year, but no second class was taken in; from this cause a break in the continuity of the stream of out-going students will occur. The success of the institution has been so far great, and, as far as can be seen, it promises to fulfil the hopes which were entertained of it in turning out a body of youths who will be acquainted with the great truths and principles which guide, and who will have learnt to follow the practices of, rational agriculture. The effect, which this knowledge will have on the country at large, must remain almost invisible for a considerable time, for it cannot be doubted that the leaven of knowledge now being disseminated will be long in causing a general uprising amongst Indian farmers against the tyranny of superstition, prejudice, ignorance, and time-honored custom. Owing to there being only one class under tuition, the cost of maintaining the institution has been proportionately heavy; when in full work, with three classes undergoing training together, the present system of feeed lecturers will be found most inconvenient, costly, and not nearly so efficient as is desirable, and it will be necessary to appoint special officers to perform the duties; when this is done, besides adding to the efficiency of the College much original investigation, in

Agricultural Chemistry, Agricultural Botany, and in the Natural History of insects useful and injurious to the farmer, will be possible. The erection of a Chemical Laboratory has been sanctioned and is being proceeded with, but the erection of the most necessary buildings—Lecture rooms and Class rooms—is still deferred.

On the Saidapet Experimental Farm many valuable and useful data were collected, as will be seen by a reference to the report. No want of cattle food was felt during the year although it began after a long drought. The cyclonic rains which fell in May, although they did great damage, were a means of raising abundant fodder crops; they also demonstrated most clearly the necessity that exists in this country for providing good shelter for cattle.

No appointment was made to the office of Inspector of Cattle Diseases during the year. A scheme is under discussion for the education in the School of Agriculture of a class of natives to fill posts of "Local Cattle Disease Inspectors."

The practice of publishing, together with the records of the actual work done by the department, separate papers, commenced in the last Annual Report, is continued.

SYDAPET EXPERIMENTAL FARM.

SECTION I.

GENERAL.

Season.—The year has not on the whole been a propitious one; for, although the total rain that fell and the number of wet days during the year were large, the peculiarities of the season were such as to minimise the value of those advantages. The exceptional cyclonic rain in May was most valuable in enabling crops and grass to be grown to feed the live-stock of the country, but the character of it, as shown in the table given below, was such as to do great damage; between 9 A.M. May 15th and the same hour on May 19th, 22·23 inches of rain fell as follows:—

From		To		Inches.
15th May ...	9 A.M.	16th May ...	9 A.M.	·65
16th „ ...	„	16th „ ...	6 P.M.	1·15
16th „ ...	6 P.M.	17th „ ...	5 A.M.	·40
17th „ ...	5 A.M.	17th „ ...	9 A.M.	·76
17th „ ...	9 A.M.	17th „ ...	12-30 P.M.	1·18
17th „ ...	12-30 P.M.	17th „ ...	5 „	·85
17th „ ...	5 „	18th „ ...	9 A.M.	8·75
18th „ ...	9 A.M.	18th „ ...	12-30 P.M.	4·10
18th „ ...	12-30 P.M.	18th „ ...	5-30 „	3·70
18th „ ...	5-30 „	19th „ ...	9 A.M.	·69
			Total ...	22·23

From this it will be seen that 16·55 inches fell in a little over 24 hours between 5 P.M. on the 17th and 5-30 P.M. on the 18th, an amount, the effects of which in bodily transporting from our fields an enormous amount of valuable material, it is difficult to appreciate fully. The storm did considerable damage to the estate and to some of our standing crops.

2. Turning to the register, it will be noticed that our rainless period, which may be said to have practically commenced in December 1876, was exceptionally prolonged, for until May 16th no rain fell, when the cyclone, already referred to, visited this part of the Presidency; after the cessation of the cyclone rain, until nearly mid June, no more rain fell, but this was not felt owing to the saturated condition of the soil; the amount of rain which was registered in June was below the average, and in July, when we usually have frequent showers, the deficiency, 1·45 inches, was very much felt by the crops sown towards the latter end of May; had the July rains been as heavy as they usually are, the cumboo and gingelly

crops would have yielded extremely well; the rainfall in the month of August was also deficient, being 3·15 inches below the average. The early part of September was very favorable for sowing crops, and, had the weather which ushered it in continued, much labor and trouble would not have been wasted in sowing crops which a fortnight's drought in the middle of the month either stunted or destroyed, necessitating in many cases resowing and causing considerable loss in every case. In October, although the total rainfall was only ·04 inches below the average, the weather continued to be as bad for the agriculturist as it was in September, there being little rain and a hot sun until nearly the end of the month. Until November no rain fell generally over the country, and as I showed in a letter, No. 57-B, dated 7th December last, printed in the Proceedings of the Board of Revenue, No. 5,290, dated 20th December 1877,* the extremely local nature of the showers which fell then was most deceptive, causing the registrations of two so closely situated places as the Farm and the Observatory at Madras to differ very greatly. The rainfall in November replenished the tanks, and then only was the cultivation of lands under them taken in hand; in many cases, I believe, not until then were any preparations made in the way of raising paddy plants in seed beds, &c. When the heavy rains ceased on November 19th a very great area of the farm was still uncropped, and it was only by the greatest exertions that so much of it was sown. In December the rains were lighter and ceased earlier than usual, which, as most of our crops were late sown, was very unfortunate. In January there was one slight fall which was very opportune and did much good to our indigo crops; since then no more rain has been registered.

North-east monsoon rains late and irregular.

3. The following table is a comparative statement of the rainfall of the past year and the average of the ten previous ones:—

Months.	1877-78.		Average of ten years.	
	Inches.	Wet days.	Inches.	Wet days.
April	...	...	·34	·7
May	22·33	5	1·53	1·15
June	2·25	7	3·36	6·4
July	1·40	7	4·37	8·9
August	3·15	12	4·97	9·0
September	5·92	10	5·49	8·7
October	9·87	12	9·91	10·0
November	17·20	13	12·18	11·9
December	3·21	5	3·24	4·6
January	·22	1	1·06	1·1
February	...	...	·89	·8
March	...	...	·16	·5

4. In the next statement I show the rainfall in each week of the year compared with the average weekly rainfall in the previous ten years.

* Appendix I.

Weeks.	1877-78.		Average of the previous ten years.		Weeks.	1877-78.		Average of the previous ten years.	
	Inches.	Wet days.	Inches.	Wet days.		Inches.	Wet days.	Inches.	Wet days.
1st Week ...	...	...	·22	·2	27th Week ...	·88	3	1·41	1·7
2nd do. ...	...	...	·03	·2	28th do. ...	...	...	1·57	1·9
3rd do. ...	...	...	...	...	29th do. ...	·35	2	3·56	3·5
4th do. ...	...	...	·01	·2	30th do. ...	·53	4	2·84	3·2
5th do. ...	...	...	1·41	·5	31st do. ...	1·95	6	1·26	1·7
6th do. ...	...	...	·12	·3	32nd do. ...	5·90	4	2·33	2·4
7th do. ...	22·23	4	·04	·2	33rd do. ...	9·37	4	2·24	3·0
8th do. ...	·10	1	·03	·1	34th do. ...	1·13	2	3·12	2·7
9th do. ...	...	...	·08	·3	35th do. ...	1·10	2	3·76	2·6
10th do. ...	...	...	1·17	1·4	36th do. ...	1·30	2	1·10	1·2
11th do. ...	1·62	3	1·36	1·8	37th do. ...	·84	2	1·05	1·5
12th do. ...	·30	3	·26	1·3	38th do. ...	...	...	·30	·5
13th do. ...	·33	1	·48	1·6	39th do. ...	...	...	·09	1·0
14th do. ...	·05	1	·26	1·0	40th do. ...	...	...	...	0·1
15th do. ...	·23	3	1·36	2·4	41st do. ...	...	...	...	0·2
16th do. ...	·35	2	·93	2·4	42nd do. ...	·22	1	·57	·5
17th do. ...	1·17	5	1·16	2·5	43rd do. ...	...	...	·49	·3
18th do. ...	1·07	5	1·25	1·8	44th do. ...	...	...	...	...
19th do. ...	·73	3	1·38	2·4	45th do. ...	...	...	·70	·5
20th do. ...	·52	3	·90	2·1	46th do. ...	...	...	...	...
21st do. ...	·71	2	1·23	1·5	47th do. ...	...	...	·13	·1
22nd do. ...	·37	2	1·28	2·1	48th do. ...	...	...	·15	·2
23rd do. ...	3·67	4	·97	2·1	49th do. ...	...	...	·08	·4
24th do. ...	·25	1	1·26	2·3	50th do. ...	...	...	...	...
25th do. ...	...	...	1·76	2·1	51st do. ...	...	...	...	...
26th do. ...	1·87	3	1·15	1·8	52nd do. ...	...	...	...	...

5. In the statement below the daily registrations of the year are given :—

April 1877.		May 1877.		June 1877.		July 1877.		August 1877.		September 1877.	
	Inches.		Inches.		Inches.		Inches		Inches.		Inch
1		1		1		1		1		1 ...	·06
2		2		2		2		2 ...	·58	2 ...	...
3		3		3		3		3 ...	·17	3 ...	...
4		4		4		4		4 ...	·13	4 ...	...
5		5		5		5		5 ...	·54	5 ...	1·60
6		6		6		6		6 ...	·18	6 ...	·22
7		7		7		7		7 ...	...	7 ...	1·76
8		8		8		8		8 ...	...	8 ...	·09
9		9		9		9		9 ...	...	9 ...	...
10		10		10		10		10 ...	·01	10 ...	·25
11		11		11 ... ·07		11		11 ...	...	11 ...	...
12		12		12 ... 1·07		12		12 ...	...	12 ...	...
13		13		13		13		13 ...	·11	13 ...	...
14		14		14 ... ·48		14		14 ...	·11	14 ...	...
15		15		15		15		15 ...	...	15 ...	...
16		16 ... ·65		16		16 ... 0·4		16 ...	...	16 ...	...
17		17 ... 2·31		17		17		17 ...	...	17 ...	...
18		18 10·78		18		18		18 ...	·30	18 ...	...
19		19 ... 8·49		19		19		19 ...	..	19 ...	...
20		20		20 ... ·25		20		20 ...	·05	20 ...	...
21		21		21 ... ·02		21		21 ...	...	21 ...	...
22		22		22 ... ·03		22 ... ·10		22 ...	...	22 ...	...
23		23 ... ·10		23		23		23 ...	·66	23 ...	...
24		24		24		24		24 ...	...	24 ...	·92
25		25		25 ... ·33		25		25 ...	...	25 ...	...
26		26		26		26 ... ·10		26 ...	...	26 ...	...
27		27		27		27 ... ·28		27 ...	...	27 ...	·65
28		28		28		28 ... ·69		28 ...	...	28 ...	·30
29		29		29		29 ... ·09		29 ...	...	29 ...	...
30		30		30		30 ... ·10		30 ...	...	30 ...	·07
...		31		...		31		31 ...	·31	...	
Total ...	Nil.	Total ...	22·33	Total ...	2·25	Total ...	1·40	Total ...	3·15	Total ...	5·92

October 1877.		November 1877.		December 1877.		January 1878.		February 1878.		March 1878.	
	Inches.		Inches.		Inches.		Inches.		Inches.		Inches.
1	...	1	...	1	1·07	1	...	1	...	1	...
2	...	2	·63	2	1·21	2	...	2	...	2	...
3	·15	3	·14	3	...	3	...	3	...	3	...
4	...	4	...	4	...	4	...	4	...	4	...
5	·66	5	...	5	...	5	...	5	...	5	...
6	...	6	·08	6	..	6	...	6	...	6	...
7	...	7	...	7	...	7	...	7	...	7	...
8	...	8	1·20	8	·09	8	...	8	...	8	...
9	...	9	1·87	9	·55	9	...	9	...	9	...
10	...	10	2·75	10	...	10	...	10	...	10	...
11	...	11	...	11	...	11	...	11	...	11	...
12	...	12	...	12	·29	12	...	12	...	12	...
13	...	13	...	13	...	13	...	13	...	13	...
14	·20	14	1·95	14	...	14	...	14	...	14	...
15	...	15	4·77	15	...	15	...	15	...	15	...
16	...	16	1·75	16	...	16	·22	16	...	16	...
17	...	17	·90	17	...	17	...	17	...	17	...
18	...	18	·78	18	...	18	...	18	...	18	...
19	...	19	·35	19	...	19	...	19	...	19	...
20	·15	20	...	20	...	20	...	20	...	20	...
21	...	21	...	21	...	21	...	21	...	21	...
22	·16	22	...	22	...	22	...	22	...	22	...
23	...	23	...	23	...	23	...	23	...	23	...
24	...	24	...	24	...	24	...	24	...	24	...
25	·16	25	...	25	...	25	...	25	...	25	...
26	·05	26	...	26	...	26	...	26	...	26	...
27	·16	27	...	27	...	27	...	27	...	27	...
28	·35	28	·03	28	...	28	...	28	...	28	...
29	1·01	29	...	29	...	29	...		...	29	...
30	6·47	30	...	30	...	30	...		...	30	...
31	·35		...	31	...	31	...		...		...
Total ...	9·87	Total ...	17·20	Total ...	3·21	Total ...	·22	Total ...	Nil.	Total ...	Nil.

6. *Insect attacks*—have been during this year particularly marked, and, although we have not suffered from them as much as the country is reported to have generally, in some cases considerable damage was done to our crops. Besides the excessive number of beetles, caterpillars and locusts, on the crops generally, soon after our monsoon-sown paddy reached the height of about 6 inches, a small greenish-colored caterpillar about 1-1½ inch in length attacked it, devouring the extremities of the leaves to such an extent that the crops for a time were much checked and stunted in their growth. To what butterfly we are indebted for this pest I do not know. In order to remove them, I endeavoured by dusting over the field with lime early in the morning, whilst the dew was still on the plants, to drive them away—this was unsuccessful; after this I dried the beds, where the caterpillars had appeared, for several days, which caused the insects to drop off the plants, and after the subsequent watering no more annoyance from them was experienced.

Caterpillar on paddy.

7. The paddy crop was also attacked, when further advanced in growth, by a maggot of which, and the manner in which it works, the following extract, from a letter, No. 109, of the Superintendent, Government Farms, to the Additional Secretary to Government, Revenue (Famine) Department, is descriptive: "a puncture mark was generally found in the stem between the upper node and the ear. On carefully splitting the stem, we frequently found the eggs of the insect lying inside immediately opposite the puncture mark; in other instances the maggot was found and nearly always solitary. This maggot is of a light yellow color, with a dark-colored head; its length is about ·60 inch and its breadth about ·06 inch. It is, I think, the maggot of a dipterous fly closely allied to the *Chlorops lineata* or the *Cephus pygmœus*, both of which do great injury in Europe to standing cereal crops in the way some of the paddy crop has been damaged at Trivellore. In some of the culms we found the pupæ. The female fly apparently deposits its eggs in the stem of the plant where they are

Maggot in paddy.

hatched, the maggots feed and enter into the pupa state. In some instances we found that the maggot had bored down through the node or joint in the straw, but such instances were exceptional." This would be, were it present in great numbers, a devastating insect, for from its position, inside the straw, it is perfectly unassailable to all ordinary endeavours to destroy it. I do not think that half per cent of the culms even in those fields where it appeared were attacked, so that the loss caused in the shape of abortive ears was not very great. I believe the great disturbance of our ordinary climatic conditions, which we have during the past two seasons suffered from, to be the chief cause of the abundance of insect pests, and therefore I do not fear that there will be any more serious recurrence of them than there is in ordinary seasons.

Attack not very severe.

8. *Fungoid diseases.*—The season has been very productive of these attacks and the long drought in October, which checked the growth of early sown crops, being followed at the latter end of the month by a deluge of rain, was the active cause, I think, in predisposing the plants to the ravages of fungi.

9. *Rust.*—This disease appeared first on an early sown crop of sorghum, which was grown from imported seed from which it is presumable that the fungus germs were derived, and, finding in the plants a prepared ground whereon to work, they some time before the seed was fit for harvest so completely enveloped the plant with a red covering, which was increasing and destroying its value as fodder, as to necessitate its being cut down; not however before the disease had spread further, and in all our sorghum it appeared, as well as in the Planter's Friend, but not to so great an extent in the latter as the former. This rust is probably closely allied to the corn rust; *Trichobasis rubigo-vera*, which is common in damp districts in England, but it is of a darker color, being more purple than red.

Rust on Sorghum severe.

10. *Smut.*—This disease, which has appeared so extensively all over the great cholum districts, showed itself in one field on the farm, but two other crops in another part of it escaped altogether; they were all sown with seed from the same crop, it having been grown on the farm the year previously, when no smut had been noticed. The crop on which the smut appeared was sown on November 9th, and a reference to the rainfall register shows that the earliest part of its growth was during very wet weather, whilst later on the conditions were completely changed and a drought prevailed. The soil of the field on which it was grown is very varied, much of it being very coarse sand, mixed with a little black clay which had been applied to improve its texture; the whole field was heavily manured, before being sown, with horse-manure, and, when the crop was some inches high, a top-dressing of saltpetre at the rate of 100 lbs. per acre was applied on November 30th. It is worthy of record that on a portion of the same land, in the season of 1875-76, a crop of yellow cholum was similarly attacked, in a much more severe manner; this crop is the one to which reference was made in paragraphs 89—93 inclusive of the report for that year.

Isolated instance on a cholum crop.

11. The smut which is here referred to, consists of a conical distortion of the seed, of a greyish color externally; when the covering is broken a cloud of fine black powder is dispersed. Cooke, is his Microscopic Fungi, thus describes the powder of the *Ustilago segetum* (corn-smut), to which this smut bears a very close resemblance :—

Description of disease.

"This powder, minute as it is, every granule of it constitutes a spore or protospore capable of germination, and ultimately, after several intermediate stages, of reproducing a fungus like the parent of which it formed a part. During the growth of the plant its virulent contents flow like a poison through the innermost tissues, and at length attack the peduncle or axis of the spikelets of the ear, raising up the essential organs and reducing them to a rudimentary state."

12. *Labor.*—The physical condition of our coolies, notwithstanding their regular employment, became so reduced during the year that it was impossible to obtain full work from them, so much so that at piece-work they often earned only from one to two annas per diem; piece-work is however adopted only occasionally, the coolies being usually paid

Supply inferior and deteriorated.

monthly wages and a certain daily task exacted from them. When extra hands were required, it was often most difficult to obtain them, and those which were obtainable, were very inferior to the ordinary run of coolies in average years. A large gang of extra hands was maintained during a considerable portion of the year in order to afford labor in the neighbourhood. The hours of work remain unchanged; they are, from April 1st to August 1st—

From 5.30 a.m.—11 a.m. and 2 p.m.—6 p.m.,

and from August 1st to April 1st—

From 6 a.m.—11 a.m. and 1 p.m.—6 p.m.

This arrangement on the whole has worked very well indeed, but I believe that it can be improved upon by a slight modification for a short period of the year.

13. *Vermin.*—During the past three years rewards have been paid for the destruction of the following:—

—	1875-76.	1876-77.	1877-78.	Total.
Cobras	41	30	19	90
Other Snakes	373	306	305	984
Rats and Bandicoots	336	307	866	1,509
Squirrels	25	102	212	339

The rewards paid have been—for cobras one anna, for other snakes six pies, for rats three pies, and for squirrels one anna; the latter animals are the worst pest we have, doing far more damage than birds, whilst they possess no compensating good qualities like the latter, which undoubtedly destroy insects, whilst they possibly destroy weed seeds, although they also at times diffuse them.

14. *Office Work.*—This consists chiefly in the recording and collating such facts as the work of the farm brings to light, the preparation from time to time of special reports on various subjects, the despatch of the current work of the farm in accounts, &c., and conducting such correspondence as is necessary in the work of the Farm and Implement Workshops, as well as in the distribution of seeds and models for the department. The number of letters written during the year was:—

Departmental	101
General Correspondence	458

15. *Establishment.*—The conduct of all the members of the Farm Establishment has, as a rule, given general satisfaction; Overseer Wilkins was permitted to resign his appointment on the 1st of January, when Ponnurunga Pillay, who, since the abolition of the Sydapet Farm Apprentice Class to which he formerly belonged, had occupied the post of Store-keeper, was appointed to act as Overseer temporarily pending the re-organisation of the department.

SECTION II.

CULTIVATION AND CROPS.

16. *Rotations.*—In this section of last year's report, I pointed out the advantages of growing crops in rotation, explaining the theoretical and practical reasons for such a system, and in paragraph 21 suggested a rotation which might be adopted over large areas in this country. With a view to determine by actual experiment, whether my suggestion is likely to be adaptable, it has been decided to try the following modification of it, commencing from the coming season, in a field of good quality, but in which the soil on the eastern and western sides varies considerably,—the former portion being stiff and clayey, the latter friable and loamy; the area of the field is

Special experiments being made.

1·78 acres and it is at present under Guinea grass, which was put down in 1876; it is not in a very clean state throughout, there being in places a considerable amount of Hurriali grass; in 1873 the land was subsoil drained, but although the operation has changed the character of the field wonderfully, the drains, as has already been reported, are not in full work at present; it is intended to follow as closely as circumstances allow the following cropping:—

1878	first year	—Maize and Cotton (manured).
1879	second „	—Indigo (limed).
1880	third „	—Yellow Cholum or Sorghum. —Gingelly.
1881	fourth „	—Guinea-grass (manured).
1882	fifth „	— Do.

17. Another rotation will be tried; for this a field of 4·82 acres has been set apart in which the soil is of lighter character than that referred to in the preceding paragraph; the field was levelled at a slope of about 1 in 200 during 1877, and a crop of indigo is now growing on it, which is, on all but one small portion, very even; the land is tolerably clean, but in a low manurial condition, and as it is made up of pieces of several old fields and its conformation having been recently altered, the past history of it cannot be given. The rotation to be followed is—

1878	first year	—Castor oil and Raggy.
1879	second „	—Maize and Cotton (manured).
1880	third „	—Guinea-grass.
1881	fourth „	—Guinea-grass.
1882	fifth „	—Dholl and Tenney (top-dressed).
1883	sixth „	—Indigo (surface dressed with manure).

18. *Subsoil drainage.*—The state of the drains laid down in 1873, *vide* paragraph 23 of the report for that year, was reported on by me in January last, and the whole subject having been discussed in a special report,* needs no further reference here.

19. *Subsoil ploughing.*—The efficacy of this operation has been recognised for a long time, but the season of 1876, as was shown in the last report, brought out most forcibly the value of deep culture in resisting the effects of drought, and during the past year every endeavour was made wherever possible to get the land stirred—generally by the use of the subsoil plough, working in the furrow left by the ordinary plough—8 or 9 inches deep before sowing, in most cases immediately before, for our soil is of such a nature that, if a heavy fall of rain occurs soon after it has been deeply stirred, it runs together and returns to nearly its original condition. Almost all of the land on which indigo was sown—about 16 acres—was subsoil-ploughed, very often on the day of sowing, and from the results as yet obtained I see no reason to regret the practice.

Great value in a time of drought.

20. Deep-ploughing, that is the inversion of the soil to a great depth, is in many cases injurious, and I would warn any one from rashly attempting the practice; it has in some cases been known to ruin good land for many years, owing to a raw subsoil, in which nothing would grow, being brought to the surface. Deep-cultivation on the other hand has almost always most beneficial effects; it is not so much that the outturn is enhanced, but that the soil is not so easily affected by climatic disturbances, and affords a larger field for the roots of plants to search for food in, thus maintaining the average of productive power for a much longer period. Unless more manure is used, no extra depth of cultivation can ever permanently maintain an increased outturn, the two things must go together. No doubt under exceptional circumstances, such as those referred to in paragraphs 31 and 32 of the last report, deep cultivation gives most astonishing results in the shape of increased outturn, but had it not been for the drought the benefits would not in that case have been so easily discoverable. I can only reiterate an opinion I have long held, that deep cultivation can, if universally followed and efficiently performed, do perhaps more

Ordinary effect of deep culture.

* Proceedings of the Board of Revenue, No. 2,004, dated 19th July 1878.

to avert famine in India than almost any thing else. It would also, if adopted, greatly enhance the producing capacity of this country, for our surface soils cannot but be in a very reduced condition for the supply of the requisite plant-food for our crops; and very much poorer than their subsoils.

Complete cure effected.

21. A remarkable result was obtained during the year in ameliorating a piece of land, the physical condition of which had become totally inimical to the growth of plants, owing to a long course of cultivation by some native cultivators in former years. From field No. 20, it had always been impossible to obtain a decent crop, so at last it was determined to break up the land with the crowbar; this was done, and at about 5 inches below the surface, a hard "pan," the cause of the bad state of the land, was broken through, the whole and completely disturbed to the depth of about 15—18 inches. The field is a small one, or otherwise the work might have been done with the plough. After undergoing this operation, a crop of cholum was taken, which produced at the rate of 2,800 lb. of green fodder per acre, notwithstanding the fact that the land was flooded when the crop was only partially grown, thus necessitating the removal of it before full maturity. Since then another crop has been sown, which now presents a most healthy and vigorous appearance.

UNIRRIGATED CROPS.

22. The table given here embodies the results obtained with several of our crops, and, although they possess no scientific importance, their practical value is considerable, forming a record of what has been done under a certain definite set of conditions. They especially show how little rain will suffice for our crops.

Number.	Number of Field.	Area of Plot.	Description of Crop.	Sowing.			Details of Harvesting.					Duration of Growth in days.	Rainfall.	
				Date.	Amount of Seed.	Seed per Acre.	Yield.						Inches.	Wet days.
							Date.	Grain or Seed.	Straw or Fodder.	Grain, &c., per Acre.	Straw, &c., per Acre.			
		ACRES.			LB.	LB.		LB.	LB.	LB.	LB.			
1	4 ...	2·15	New Orleans Cotton	20th November 1876 ...	25	11·63	From 19th May to 9th September 1877.	*501·5	...	233·25	...	293	34·62	43
2	15 ...	4·42	Indigo	11th December 1876 ...	47	10·63	9th April 1877	913	...	206·56	...	119	·16	4
									Bundles.		Bundles			
							20th June 1877 ...	...	245	...	55·43	72	24·20	9
							28th August 1877 ...	...	213	...	48·19	69	4·67	22
3	29 ...	2·68	Gingelly	29th May 1877	30	11·19	30th August 1877 ...	750	...	280	...	92	6·54	26
									lb.		lb.			
4	18 ...	3·85	Horse-gram and Cumboo ...	22nd May 1877 ...	100	25·97	11th August 1877 ...	...	‖19,520	...	5,070	80	5·41	22
					75	19·74			Bundles		Bundles			
5			Indigo	5th December 1877 ...	50	12·99	13th March 1878 ...	...	122	...	31·69	98	1·15	4
									lb.		lb.			
6	13 ...	2·73	Horse-gram	21st May 1877	60	21·98	16th September 1877 ...	...	‖19,980	...	7,318	117	10·93	34
7			Planter's Friend	28th September 1877 ...	60	21·98	12th January 1878 ...	304	32,427	111	11,878	106	30·65	32
8	34 ...	1·32	Horse-gram	1st June 1877	35	26·52	31st July 1877	...	‖4,580	...	3,469	60	3·70	15
									Bundles.		Bundles			
9	34 ...	1·875	Indigo	29th November 1877 ...	20	10·66	9th March 1878 ...	...	124	...	66·13	100	3·43	6
							24th May 1878 ...	...	80	...	42·66	86	3·57	6
									lb.		lb.			
10	10-I.	2·128	Maize	24th September 1877 ...	32½	15·27	22nd December 1877 ...	¶2,355	10,045	¶1,107	4,720	96	32·22	34
			Cotton	10th September 1877 ...	39	18·32	Up to 1st July 1878 ...	†1,259	...	591·63	...	294	38·41	45
11	33 ...	4·75	Maize	27th September 1877 ...	36	9	26th December 1877 ...	¶1,900	5,616	¶400	1,182·32	90	31·30	33
			Cotton	1st September 1877 ...	20	5	Up to 1st July 1878 ...	‡1,386	...	291·79	...	277	42·14	50
12	10-III.	·746	Sorghum	20th November 1877 ...	8	10·73	16th February 1878 ...	304	6,700	407·50	8,981·23	88	3·46	7
13	14 ...	3·47	Sorghum	21st November 1877 ...	45	12·97	20th February 1878 ...	824	23,083	237·46	6,652·16	91	3·46	7
14			Sorghum	12th September 1877 ...	10	9·17	10th December 1877 ...	...	‖17,924	...	16,444	89	31·83	33
									Bundles.		Bundles			
15	10-II.	1·09	Indigo	13th December 1877 ...	5¾	5·28	28th February 1878 ...	...	25	...	22·93	108	·22	1
							22nd May 1878 ...	...	25½	...	23·39	83	3·57	6
16	16 ...	4·82	Indigo	26th November 1877 ...	32	6·64	28th February 1878 ...	...	291	...	60·37	94	3·46	7
							21st May 1878 ...	...	83	...	17·22	82	3·57	6
17	32 ...	4·25	Indigo	27th November 1877 ...	58	13·65	7th March 1878§ ...	...	211	...	5·42	100	3·46	7
							21st May 1878 ...	...	218	...	51·29	75	3·57	6
									lb.		lb.			
18	15-I.	4·09	Planter's Friend	12th & 13th Nov. 1877.	105	25·67	20th February 1878 ...	554	13,104	135·45	3,203·91	112	13·96	13
			Castor-oil		31	7·57	Up to 31st May 1878 ...	762	...	186·30	...	199	4·57	7
19	15-II.	3·69	Planter's Friend	22nd November 1877.	70	18·97	12th March 1878 ...	715	21,383	193·76	5,794·85	101	3·46	7
			Castor-oil		25	6·77	Up to 6th July 1878 ...	678	...	183·74	...	226	6·17	10
20	17-I.	4·02	Yellow Cholum	6th November 1877 ...	91	22·63	13th February 1878 ...	533	17,732	132·58	4,410·94	99	19·86	17
21	31 ...	1·28	Yellow Cholum	4th October 1877 ...	65	50·78	11th January 1878 ...	21¼	12,610	16·60	9,851·56	99	30·13	29

* Seed cotton yielded 144 lb. lint = 67 lb. per acre.
† Do. yielded 349·5 lb. lint = 164·23 lb. per acre.
‡ Seed cotton yielded 397·75 lb. lint = 83·73 lb. per acre.
§ 1,740 square yards kept for seed, yielded 350 lb.
‖ Green fodder.
¶ Weight of cobs.

23. The crop first mentioned is that to which reference was made in paragraph 53 of the last report, the outturn, 67 lb. of cleaned lint per acre is, considering the season, not low. No. 2 is the indigo crop referred to in paragraph 60 of last year's report, and the full yield here given was worth in all Rupees 122-8-0 or about Rupees 27-12-0 per acre; an exceedingly good return when the sowing season is taken into consideration.

24. No. 3, Gingelly (*Sesamum Indicum*) was sown on a fair piece of land—sandy loam; the seed used was poor, so far so that in several cases ryots, who had purchased from us of the same lot, failed to get any crop; even where they did succeed in obtaining a plant, the shallow cultivation they pursued led to the withering of it before it attained maturity; this crop suffered considerably from the unusual dryness of the weather in July, and no doubt the outturn was materially affected thereby.

25. No. 4, the crop, a mixture of cumboo (*Penicillaria spicata*) with horse-gram (*Dolichos uniflorus*), was sown in this manner with the idea that the cereal would form a support to and keep the pulse off the ground, thus improving the fodder; the yield obtained in only 80 days is very good. The field in which this was grown was ploughed up soon after this harvest and again sown with horse-gram, on the 5th September, which crop was ploughed in as manure. The intention had been for a crop of cholum to follow this, but the season was so late that it was considered advisable to sow indigo, No. 5, on this land, which is a rather coarse sandy loam of low natural fertility, but in fair condition. The details of indigo crop cannot be given until next year, but it is worthy to remark that the land has produced as follows :—

13th Feb. 1877.—Yellow cholum ...	straw	10,328 lb.	= 2,683 lb. per acre.
	grain	480 lb.	= 125 lb. do.
11th Aug. 1877.—Horse-gram and cumboo,	fodder	19,520 lb.	= 5,070 lb. per acre.
14th Nov. 1877.—Horse-gram, (estimated)	manure	11,500 lb.	= 2,987 lb. do.
13th Mar. 1878.—Indigo, green plant, ...		6,710 lb.	= 1,743 lb. per acre.

26. No. 6, Horse-gram, is another crop sown after the cyclone in May, which produced heavily; the land on which it was grown is of varying quality, and this crop being the first one after levelling, speaks well for the valuable qualities of a dressing of horse-manure laid on early in the year. No. 7, a crop of Planter's friend (*Sorghum Kaffrarium*) followed the horse-gram without any special manuring, but was top-dressed when about 6 inches high; the yield of grain is low, but that of fodder good.

27. No. 8, Horse-gram, was grown after a crop of Planter's friend (see paragraph 43 of the last report) and has been followed by Indigo, No. 9. The yield from this field per acre since the commencement of 1877, is as follows :—

31st January 1877—Planter's friend	straw	3,911	lb.
	grain	454	„
31st July 1878—Horse-gram, green	fodder	3,469	„
9th March and May 24th—Indigo, green plant		5,440	„

A small piece of land was added to the field and the whole partially levelled after the horse-gram was harvested, and to this the lowness of outturn from the second cutting of indigo must be attributed.

28. No. 10, Maize and Cotton, suffered greatly from the drought in October and, being sown on newly levelled land, was uneven and patchy. The full record of the cotton crop will be given next year. No. 11 is again Maize and Cotton; the former crop was ruined by drought, but the latter is one of the finest I have yet seen on this farm; the results of this crop also cannot be recorded in full this year.

29. Nos. 12, 13, and 14, Chinese Sugar-cane (*Sorghum saccharatum*), were all grown on very similar soils; Nos. 12 and 13 being manured with horse-manure, and No. 14 with horse-gram ploughed in, as well as top-dressed with saltpetre. No. 12 being attacked very badly by "rust," it was necessary to remove it, when indigo, No. 16, was put in immediately, with very partial success in obtaining an even plant over the field owing to want of sufficient moisture for germinating the seed.

30. Nos. 16 and 17, Indigo, cannot be referred to fully this year; the former is on a newly levelled field of rather inferior quality; the latter follows a crop of yellow cholum, (see paragraph 44 of last report) and was manured with indigo compost and sheep-manure.

31. Nos. 18 and 19 are two different sides of a field which was levelled during the past year; it was heavily manured with box manure immediately before sowing; the whole field was subsoil ploughed, but, whilst the work in Plot I was being performed, very heavy rain fell, to a certain extent vitiating its effects by beating down and consolidating the surface to an extreme degree. Plot II was put in under far more favorable circumstances, but 10 days later.

32. Nos. 20 and 21, Yellow Cholum (*Sorghum vulgare*), were crops grown on inferior soils of very variable quality; the former was attacked by "smut."

33. *Cost of Production.*—The following statement shows the actual cost incurred in producing some of the crops and the value of the produce referred to in the table given in paragraph 22 above:—

No.	Crop.	Gingelly.	Horse-gram.	Planter's friend.	Sorghum.	Sorghum.	Indigo.
1	Field Number	29	13	13	10 (I)	14	16
2	Area of Plot	2·68 acres.	2·73 acres.	2·73 acres.	1·09 acres.	3·47 acres.	4·82 acres.
		Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
3	Cost of labor in preparation for sowing ...	2 7 8	3 2 0	12 8 0	2 10 0	6 6 0	18 10 0
4	Do. seed and sowing	3 11 6	5 3 4	3 14 0	3 9 0	4 6 8	3 6 8
5	Do. after-cultivation	3 8 10	5 14 0	2 14 8	2 15 0	6 14 0	14 2 0
6	Do. harvest and preparation of grain ..	6 7 0	6 2 8	8 1 4	2 8 0	7 9 0	*9 7 0
7	Do. labor and seed per acre ...	6 0 8	7 7 5	10 0 5	10 10 8	7 4 4	9 7 5
8	Do. manure and application of it ...	...	28 12 0	38 3 4	14 10 4	16 7 0	22 10 0
9	Do. manure chargeable to the crop	...	15 0 0	26 3 4	7 5 2	8 3 6	15 10 0
10	Do. manure chargeable per acre ...	...	5 7 11	9 9 7	6 11 6	2 5 11	3 3 10
11	Value of grain or seed	34 4 8	None.	10 2 0	None.	27 7 6	None.
12	,, straw or crop	None.	79 14 8	108 1 6	54 13 0	76 15 0	*54 13 0
13	Total outturn per acre	12 12 9	29 4 5	43 4 10	50 4 7	30 1 5	*11 5 11
14	Cost of production per acre	6 0 8	12 15 4	19 10 0	17 6 2	9 10 3	*12 11 3

The figures do not require any comment; the areas referred to are sufficiently large to allow the results of these experiments to be really representative and to eliminate the danger of errors in calculation which, for such purposes in dealing with small areas, are sometimes likely to occur. The only point to which I would draw attention is the large outturn obtained from No. 13 field.

IRRIGATED CROPS.

34. In the table which follows, the results of some of the crops grown with the aid of irrigation water, in some cases raised by machinery, in others supplied by gravitation from the Mylapore tank, are given. The tank was filled by cyclone rains in May, when an enormous body of water was allowed to run to waste from it owing to the calingulah being left open long after the rain had ceased to fall or the drains to run; the rain ceased on the evening of May 18th, and up to the 23rd the water in the waste channel flowed through the farm bridge in a stream about 6 feet deep and 45 feet wide at a rate exceeding $2\frac{1}{2}$ miles per hour, whereas it is questionable whether the calingulah might not have been safely blocked 36 hours after the rain ceased, and that thus at least 10,000,000 cubic yards of water, or enough to irrigate 700 acres of paddy under the ordinary native management, might not have been saved.

Great loss of water from Mylapore tank in May.

35. The tank was again filled at the beginning of November, but owing to the defective blocking, and the low level of the calingulah stones, the tank, which formerly used to hold water for five, was empty in three months after the rains ceased. The utterly wasteful consumption of water by the people of Mylapore, &c., which has so often been referred to, remains still unchecked.

Decreased capacity of Mylapore tank.

36. The results were as follows:—

* First and second crop only.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth in days.	Rainfall.	
				Date.	Amount of Seed.	Seed per Acre.	Date.	Outturn.					Inches.	Wet days.
								Grain.	Straw.	Grain per Acre.	Straw per Acre.			
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.			
1	Yellow cholum	1-II ...	1·02	21st April 1877 ...	40	39·22	17th-28th Aug. 1877	...	*16,918	...	16,586	129	28·87	30
2	Do.	1-III ...	·63	19th May 1877 ...	20	31·74	14th Sept. 1877 ...	...	*2,144	...	3,403	118	19·42	34
3	Do.	11-I ...	1·02	3rd Mar. 1877 ...	50	49·2	19th June 1877 ...	...	*7,730	...	7,578	108	23·95	8
4	Do.	11-II ...	1·64	4th April 1877 ...	40	24·4	14th July 1877 ...	...	*24,592	...	14,385	101	24·63	8
5	Cumboo			7th April 1877 ...	10	31·2	3rd June 1877 ...	...	*1,705	...	5,328	56	22·33	5
6	Sumba paddy	35-I ...	·32	1st Nov. 1877 ...	16	50	2nd Feb. 1878 ...	121	995	378·1	3,109	114	20·63	19
7	Car paddy			26th May 1877 ...	50	83·3	6th Sept. 1877 ...	949	6,500	1,581·7	10,833	103	8·73	30
8	Sumba paddy	35-II ...	·6	1st Nov. 1877 ...	21	35·0	23rd Feb. 1878 ...	494	2,582	823	4,303	112	20·63	19
9	Car paddy	...	·37	14th July 1877 ...	Planted.		29th Sept. 1877 ...	722	4,284	1,920	11,283	77	10·40	28
10	Do.	...	·69	21st July 1877 ...	Do.		7th Oct. 1877 ...	828	3,416	1,183	4,881	78	11·24	30
11	Do.	35-IV ...	·63	29th June 1877 ...	Do.		12th Sept. 1877 ...	1,130	5,320	1,796	8,459	75	8·58	26
12	Sumba paddy	35-V ...	·12	1st Nov. 1877 ...	12	101	23rd Feb. 1878 ...	139	1,437	1,164	12,033	114	20·63	23
13	Do.	35-VI ...	1·17	14th Nov. 1877 ...	15½	13·25	8th Mar. 1878 ...	338	1,646	288	1,407	114	13·96	13
14	Raggy	35-VII ...	1·20	26th June 1877 ...	Planted.		20th Sept. 1877 ...	773	9,390	640	7,779	86	8·58	26
15	Car paddy	36-II ...	1·14	27th June 1877 ...	Do.		11th Sept. 1877 ...	1,474	6,272	1,291	5,479	76	8·58	26
16	Raggy			29th June 1877 ...	Do.		23rd Sept. 1877 ...	514	3,568	546·8	3,796	86	8·58	26
17	Sumba paddy	36-III ...	·94	12th Nov. 1877 ...	24½	29·88	28th Feb. 1878 ...	976	4,600	1,038	4,894	108	13·96	13
18	Car paddy	35-III ...	·6	20th Nov. 1877 ...	20	33·3	7th Mar. 1878 ...	218	858	363·3	1,430	107	3·46	7
19	Sumba paddy	37-I ...	·625	23rd Nov. 1877 ...	Planted.		12th Mar. 1878 ...	1,204	3,988	1,926	6,371	91	·51	2
20	Car paddy	37-II ...	·45	21st Nov. 1877 ...	15	33·3	14th Mar. 1878 ...	322	1,350	715	3,000	113	3·46	7
21	Do.	37-III ...	·3	21st Nov. 1877 ...	15	50	13th Mar. 1878 ...	246	1,838	820	4,500	112	3·46	7
22	Do.	37-IV ...	·24	22nd Nov. 1877 ...	20	81·7	13th Mar. 1878 ...	1,008	3,196	4,200	13,326	111	3·46	7
23	Sumba paddy	37-V ...	·4	10th Dec. 1877 ...	Planted.		11th Mar. 1878 ...	420	2,092	1,050	5,230	109	3·46	7

*Cut green for fodder.

Possibility of growing food for cattle in time of drought.

37. The first 4 crops referred to are most interesting in showing what could have been done, wherever wells existed, in growing fodder for the preservation of the lives of many of the cattle stock of the country which were lost, as well as in maintaining all in good bodily condition ready for use when the time for cultivation arrived. Twenty pounds of forage per diem per head of stock would have kept many thousands alive, and taking 8,000 lb. to be a fair average obtainable yield per acre in three months by the use of irrigation, more than four cattle per acre under water could have been maintained or about 20 per well. The yields obtained in Nos. 1 and 4 are very good, and were, owing to the rain in May, which was however very superabundant for the purpose, produced at an exceedingly low rate, as will be seen further on.

38. Nos. 5 and 6, Cumboo and Sumba paddy, were grown on the same land; the plot also produced a crop of seedling Car paddy plants for planting out Nos. 9 and 10; the total outturn, nearly 380 lb. grain and 8,400 lb. of straw, is good.

39. Nos. 7 and 8, Car and Sumba paddy in succession on the same land, are extremely good results. Both crops were thinned to a considerable extent to provide seedlings for other plots, and in No. 7, 231 square yards or 8 per cent. of the total area was cut out before harvest owing to its having withered; the straw then received was not brought to account.

40. Nos. 9 and 10, both Car paddy, were grown in the bed of the Adyar; the former in a small triangular bed, which always produces well; and the latter on a piece of land one-third of which at least is more or less salt, and on that portion there was very little crop. Both plots were well manured and water was supplied in sufficient, but not in great quantities, as it had nearly all to be raised by manual labor with the bale or picottah from the river, which was very low at the time.

41. No. 11, Car paddy, is a striking return, and, as the land has also carried a crop of Sumba paddy, Nos. 12 and 13, in one part yielding at the rate of 1,164 lb. and in the other 288 lb. per acre, the outturn from the land during the year has been remarkably heavy. The land is a fair loam, with adequate drainage; the latter point being a most important one.

42. No 14, Raggy (*Eleusine coracana*), was a very good crop, and the outturn would have been much greater, as it would in No. 16, had there not been a great deal of petty theft from the field before and during harvest. This crop is a most difficult one to harvest, and the process of threshing very tedious and expensive owing to the persistency with which the grain adheres to the ear.

43. The remaining crops referred to in the table do not call for special notice. It is however worthy of remark that Nos. 19 to 23 inclusive are the only good crops which have for many years been obtained from the land on which they were grown; this land has been lying waste for two years, owing to the want of water for its cultivation in paddy and its inadaptability to any other crop. I would also direct attention to the following statement showing the average duration of growth of the crops above referred to and comparing it with the time usually said to be necessary :—

	Days.
Car sown May 1877	103
Car planted June and July 1877	76
Sumba sown November 1877	112
Sumba planted November 1877	100
Car sown November 1877	111

Ordinarily with native cultivators

Car takes about...	if planted	135
	if sown	165
Sumba takes about	if planted	120
	if sown	150

The diminution here shown I attribute partially to earlier cutting, a practice which the ryot can learn greatly to his own advantage, and also to the plentiful use of manure, and the economical supply of water; many of the crops not receiving, as far as a rough measurement would show, more than 3 feet of irrigation water at the outside.

44. The following table gives the details of the cost of growing, and the value of the produce of some of the crops referred to in paragraph 36 above :—

No.	Crop.	Yellow Cholum.	Yellow Cholum.	Car Paddy.	Sumba Paddy.	Raggy.	Sumba Paddy.	Sumba Paddy.
1	Field Number and Plot ...	1 Plot 2.	11 Plot 2.	35 Plot 2.	35 Plot 2.	36 Plot 3.	36 Plot 3.	37 Plot 1.
2	Area of Plot in acres ...	1·02	1·64	·6	·6	·94	·94	·625
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
3	Labor in preparation for sowing.	15 8 0	4 14 0	9 0 0	6 8 0	3 7 6	8 2 0	3 11 0
4	Seed and sowing	2 4 0	2 12 0	2 2 0	0 14 6	2 0 0	1 1 0	7 0 0
5	After cultivation	2 9 5	3 7 0	None.	None.	None.	1 5 0	None.
6	Watering	12 1 0	14 8 0	10 10 0	0 4 0	5 8 8	0 4 0	0 4 0
7	Harvest and preparation of seed	2 9 4	3 7 0	4 12 0	2 12 0	9 4 8	1 15 0	3 0 0
8	Cost of labor and seed per acre.	34 4 9	17 10 11	44 2 8	17 5 6	21 9 7	13 7 11	22 4 10
9	Cost of manure and application of it	21 8 0	13 10 0	12 13 4	10 0 0	7 10 8	12 10 0	2 7 0
10	Cost of manure chargeable to the crop ...	15 6 0	9 12 8	6 9 4	11 8 0	5 2 8	10 6 0	1 7 0
11	Do. do. per acre ...	15 1 2	5 15 6	10 15 7	19 2 8	5 7 11	11 0 7	2 4 10
12	Value of grain or seed ...	None.	None.	29 5 6	14 12 5	20 3 2	26 6 1	32 8 1
13	Do. straw or crop ...	82 14 10	122 14 7	32 8 0	10 5 3	17 13 5	15 5 4	13 4 8
14	Total outturn per acre ...	81 4 10	74 15 2	103 1 2	41 13 5	40 7 5	44 6 0	73 4 5
15	Cost of production per acre ...	49 5 11	23 10 5	55 2 3	36 8 2	27 1 6	24 8 6	24 9 8

These figures bring out the results obtained so clearly that there is scarcely any need for comment; attention is however drawn to the fact that the fourth, sixth and seventh crops were grown with water supplied by gravitation from the Mylapore tank; this accounts for the low cost of watering in these cases. Crops Nos. 3 and 4 were grown on the same land and gave a gross outturn valued at Rupees 144-14-7 per acre, whilst another field, the fifth and sixth crops, gave an outturn of Rupees 84-13-5 per acre. In valuing the crops the selling price of the grain was taken, and in the case of fodder or straw the price ruling at the time of harvest was adopted. The difference of cost in producing the first two crops on the table shows how a slight difference in the quality and condition of a piece of land may alter the results, in one case the labor bill was twice as heavy as the other, this being due partly to the soil of the plot on which the former was grown being much stiffer and not so free from weeds; the slight difference of the time of sowing in the two cases also probably affected the cost.

Cost dependent on conditions.

SPECIAL CROPS.

45. *New Orleans Cotton.*—The crop referred to in paragraph 53 of the last report yielded, before it was taken up in the beginning of September 1877, 501·5 lb. of cotton in seed, which produced 144 lb. of lint, or about 67 lb. per acre; this, considering the date, fully two months after the usual time, at which it was sown, and the abnormal character of the season, is satisfactory; the measure of success attained must be attributed to deep tillage and a plentiful use of manure. This season two fields, one of $4\frac{3}{4}$ acres and the other of $2\frac{1}{8}$ acres were sown with this crop and have already been referred to above at paragraph 28.

Fair crop in a bad season.

46. The table given below is a continuation of that given in paragraph 54 of last year's report, but owing to the abnormal condition of the season of 1877, the first part of it cannot be valued very highly as bearing on the question of the best linting season.

Date of Ginning.	Amount of Seed Cotton ginned.	Amount of Lint received.	Per cent. of Lint.	Details of Gathering.
	LB.	LB.		
November 7th, 1876 ...	127·5	34	26·7	Gathered in Oct. and Nov.
December 23rd, 1877 ...	63	20	31·76	Do. November.
April 25th	188	52·5	27·93	Do. February 31½ lb. Do. March 38½ lb. Do. April 118 lb.
May 14th	50	17·5	35	Do. April.
July 3rd	115	35	30·44	Do. do. after 3rd 28 lb. Do. May 45 lb. Do. June before 5th 42 lb.
September 24th	78	19	24·36	Do. August and September before 7th.
December 13th	140	35·5	25·36	
December 21st	93	25·5	27·42	Gathered in Dec. after 18th.
December 31st	148·5	43·5	29·29	
January 18th, 1878 ...	213·5	57	26·7	Do. do. 13 lb. Do. January 200·5 lb.
February 2nd	10	3·25	32·5	Do. do. before 18th.
March 2nd	55	17	30·91	Do. February after 25th.
Do. 23rd ...	136	54	39·7	Do. after Mar. 2nd No. 33.
	127	41	32·28	Do. do. No. 10.
Do. 30th ...	147	44	29·93	Do. do. No. 33.
	124	38	30·65	Do. do. No. 10.

It may be observed in passing that the cyclonic rain in May 1877 had a very bad effect on the yield of that season's crop, for, from its excessive character, the soil was so completely saturated that from June 5th to August 11th no seed cotton was received from the field, as the plants were during that period solely producing wood and leaf; the dry July which we had was very beneficial as it checked this tendency.

47. Referring to the ginnings of the gatherings of the crop now on the ground, the first and most interesting point is the early date at which the first gathering was made, for, if we eliminate 1877 as being abnormal, it will be seen that it took place between five and six weeks earlier than those of 1875 or 1876, as the following statement shows: —

Date of Sowing.	Date of first receipt.	Days to first Gathering.
5th September 1877 ...	18th December 1877 ...	104
18th November 1876 ...	31st March 1877	133
23rd September 1875 ...	20th January 1876 ...	119
16th September 1874 ...	2nd February 1875 ...	139

Useless period of growth reduced.

These figures also show that the earlier linting season was not due solely to earlier sowing, although that operation took place about a fortnight before it did in 1875 and 1874, but to the unproductive period of growth having been reduced temporarily or permanently—time alone can show—by 25 days or about 19 per cent. If this habit be confirmed, and by the use of the earliest gathered seed only in future it probably will be, a great step will be made, but not a greater one than the improvement which seems to have been effected in the style of the plant; formerly it was low, not above 2½ feet high, with a wide branching growth; this year many of the plants are four or five feet high with straight stems, and as yet have produced few side branches.

48. I do not attribute the low percentage of lint shown in the early gatherings this year to the proportion of that substance being low, but rather to the fact that

when gathered all the cotton in seed is slightly damp, and being brought to account in this state, an apparently low percentage of lint is shown. At ordinary times of the year our loss in ginning varies from 3 to 10 per cent., the latter figure being reached in September when the cotton in seed is never dry when gathered, whilst early in the year, about April and May the loss is at the former figure, the slight loss being due to dust and small portions of the cotton and to drying after receipt from the field. The loss in ginning in December and January this year however has exceeded the highest figure and, even if we only attribute the excess loss above the average to the presence of larger quantities of moisture when received, nearly 10 per cent. should be deducted from the amount ginned, which would cause a proportionate increase to the percentage of lint yielded. For instance, the two lots ginned on March 23rd were weighed off when dry, immediately before ginning and found to have lost the first 14½ and the second 9 per cent. since gathering; during January, when the dews are heavier than in March, the loss in weight was probably considerably higher. When the deduction was made, it caused the wonderful figure of 39·7 per cent. of lint to be attained instead of 33·9.

Low percentage of lint explained.

49. This investigation is being proceeded with, and the full details of the results obtained from the crop now on the ground will be given in the next report.

50. *Bahmieh Cotton.*—Some seed of this variety, which is supposed to be a hybrid between the ordinary cotton plant (*Gossypium vitifolium*) and the edible okro or ladies-fingers (*Hibiscus esculentus*), was obtained early last year from Mr. Henry Carcas of Birket-el-Sabh, a village of Lower Egypt between Cairo and Alexandria. A plot of 1,260 square yards was sown with it on the 23rd of August, in a field the soil of which had been manured with horse-manure. The fertility of the land is, compared with our soils generally, fair, but its condition was low, probably in this respect comparing most unfavorably with the soil on which the crop from which the seed sown was produced, had been grown and thus exposing the crop to some risk of failure from the sudden change. The following is a translation of a description of the plant, which appeared in a French paper published in Egypt:—

"It is possible that this new variety may be the result of a cross between the *Hibiscus esculentus* and the ordinary cotton plant; it is further a most interesting plant because it yields much more heavily than the ordinary cotton. The growth is more upright than that of the ordinary cotton (*Gossypium vitifolium*); it has a straight unbranching stem, in this respect differing from the latter plant, which is of shrubby form with numerous branches themselves again branching and producing irregularly at their joints a bole of cotton. On the contrary in the Bahmieh cotton plant the stem is straight, taller and unbranched, excepting perhaps a few small branches at its foot. The boles grow in clusters of two or three at the axils of the leaves."

Mr. Carcas has also favored me with a description as follows:—

"The new cotton plant grows to the height of 8 to 10 feet on one vertical stem, without any horizontal branches, with very few leaves, and gets covered with a quantity of cotton buds, as much as eighty have been gathered from one plant. It happens however, but not as a general rule, that one or two sprouts are often seen shooting off the stem within 3 to 5 inches from the ground growing vertically along side the mother plant, but never acquiring a full development nor yield, consequently they should be considered as parasites and ought to be suppressed in proper time. The absence of branches allows the plant to grow comfortably very close together, and as much as four plants can be allowed to grow in a square foot of land."

"Its origin remains unknown, but evidently is a matrimony between hemp and cotton. The Arabs being in the habit of planting round their cotton fields a small strip of hemp, the phenomena must have originated from the "polen" of either of the two plants having been carried by the wind or bees from one flower to the other."

"It requires no particular mode of treatment from the ordinary cotton plant."

The crop grown here did not come up to the expectations formed of it from the descriptions given, for, from some reason which I am unable even to suggest, although the plants came up rather more uprightly than our ordinary cotton (New Orleans), after some time it began to throw out branches near the roots and occupied fully as much space as the other plants do. When several months old, the crop became

Not a crop apparently of great value.

blighted and at the end of March it was removed. The yield of cotton from the plot was very low, partly no doubt from the poverty of the soil, and partly probably from the crop being blighted, as well as from the well-known infertility common to most hybrids.

51. Another plot was planted in December 1877, but with the same results regarding the habit of growth as in the first case; the plants are now (July 1st) looking well, but have not produced much cotton. A further small supply of seed was received from the Government of India on the 26th of March for experiment; we had at the time a sufficient supply in stock from the crop previously grown.

52. *Sunn Hemp* (Crotalaria juncea).—During the year some experiments were made in the growth and best period for cutting this crop. For this purpose a piece of land measuring 585 square yards was selected; it is a light and very sandy loam, recently levelled with a slope of about 9 inches in 300 feet. The land was prepared for an ordinary crop by ploughing and harrowing until it was reduced to a proper state and the seed was then sown with the drill in rows 9 inches apart at the rate of 12 lbs. per acre. The land had been manured with horse-manure at the rate of 12 loads, or about 4 tons per acre. The after-cultivation consisted of two hand hoeings, and the total cost of production may be put down per acre as follows :—

History of crop.

	Rs.	A.	P.
Preparation of soil for sowing	3	8	0
Cost of seed and sowing	1	0	0
Half cost of manure	3	0	0
After cultivation	2	8	0
Cutting or pulling plants	1	8	0
Cleaning fibre	2	8	0
Total ...	14	0	0

The following table gives the outturns obtained; the plot was divided into three equal portions, and each of these again, excepting the last, was sub-divided into two; the whole of each main division was harvested on the same day, one half being pulled and the other reaped close to the ground; the land however became so hard before the last plot was reaped that none of it could be pulled up with the roots. The results are as follows :—

Date of harvest	4th December 1877.		15th December 1877.		24th December 1877.
Area of land	877·5 sqr. ft.	877·5 sqr. ft.	877·5 sqr. ft.	877·5 sqr. ft.	1,755 sqr. ft.
Condition of plant when cut.	Flowering.		Seed pods formed and partly matured.		Seed ripened.
Method of harvest ...	Cut level with ground.	Pulled up by the roots.	Cut level with ground.	Pulled up by roots.	Cut level with ground.
Duration of steeping and temperature of water.	6 days; 78°		4 days; 82°		4 days; 82°
Yield of fibre	6 lb.	6·5 lb.	8·5 lb.	9·75 lb.	17·5 lb.
Yield of fibre per acre ...	300 lb.	325 lb.	425 lb.	487·5 lb.	437·5 lb.

Remark.—All the samples were coarse, lightish yellow in color, and of nearly similar strength.

After being removed from the ground, the stems were tied in bundles of about 50—100 each and placed to steep in a tank, being weighted down to keep them under water; when considered fit, the fibre was removed from the wood by splitting it off by the hand; it was then washed and dried; it comes off in a very matted and tangled condition. There was not much difference in the quality or color of the different cuttings, excepting that the last was rather stronger than any of the others.

Process of preparation.

53. *Jute* (Corchorus capsularis).—At paragraphs 98—102 of the report for 1874-75, the results of some experiments made with *Corchorus olitorius* were given, and it was shown that the variety was not suited to Madras. Some seed of the variety now referred to was obtained from the Godavery District and sown on the Farm and the seed of the crop, which was fairly a successful one, was collected and again sown on 5th September last on a piece of land adjoining that on which the Sunn Hemp referred to above was afterwards grown. The land was treated in the same manner as that for the Sunn Hemp and the after-cultivation was the same. When the crop reached the stage of maturity at which it was judged to be fit to cut, the experiment recorded in the following table was made :—

History of crop.

Date of harvest	29th November 1877.	
Area of ground	420 square yards.	
Condition of plant when cut ...	Seed partially matured.	
Method of harvest	Reaped close to ground.	Pulled up by the roots.
Duration of steeping	11 days.	
Temperature of the water	82°	
Yield per plot	5·75 lb. fibre.	6·75 lb. fibre.
Yield per acre	599 lb. fibre.	703 lb. fibre.

The fibre produced was very similar in both cases, but the increased yield of 100 lb. per acre when pulled, shows that that method of harvesting seems to be the best; the weight alone however cannot be taken as a conclusive proof, for, the ends of the pulled stem-fibre are more woody than the other. The fibre was cleaned in the same way as the Sunn already referred to, and came out in a fine glossy silky state averaging from 2—3 feet in length, and, of great strength. In a better season and on a less sandy soil heavier returns and a better sample might have been obtained; in this case, the crop suffered considerably from the drought in October and probably did not attain such a fine growth as it might have done. The samples obtained were referred to the Chamber of Commerce for valuation but their report has not yet been received.

54. *Rhea* or *China-grass* (Bœhmeria nivea).—The plants, referred to at paragraph 140 of the report for the year 1875-76, have become in a measure acclimatized and under partial shade they flourish. There is only a small plot of about 4 square yards growing at present on the farm, but from this in one cutting ¼ lb. of fibre was obtained. From the nature of the plant not less than four and perhaps more cuttings could be obtained per annum, but to do this abundant manure and some irrigation would be required. The cost of growing the stems need not be heavy, but until some

Growth possible under shade with irrigation.

machine capable of cleaning the fibre cheaply is produced, it is not of much use endeavouring to introduce the plant here where we have many other more easily manipulated, though perhaps not so valuable fibres.

55. *Indigo.*—In paragraph 59 of my last report I referred shortly to this crop, and pointed out the difficulties which in the earlier stages attend its culture. It was only in the season of 1876 that I can say that an approximation to the method, by which a fair measure of success can be obtained with this crop, was arrived at; in the two previous seasons, those of 1874 and 1875, our sowings of Indigo were attended with failure oftener than otherwise. The experience of the past year confirms my belief in the system we have now adopted, and under ordinary circumstances on light land, I think it will be found to stand the test of the future, and as the crop is a very important one, I shall now describe the culture adopted in detail.

Successful system of growth arrived at.

56. Land intended for indigo should be broken up well in September or earlier if possible, and at some convenient time it should be ploughed and subsoiled as deeply as possible, every exertion must be made to remove weeds, especially those of a rapid habit of growth; for indigo, when it first appears above the ground being a very small and tender seedling, requires to have the fullest and freest liberty in order that it may be got beyond that stage as rapidly as possible. Shortly before sowing, the surface soil must be brought into as fine a tilth as is possible, such as is desired for turnips in England; this can generally be attained without much difficulty unless very wet weather prevails, by the aid of those processes, which the agriculturist knows how and when to make use of, such as ploughings, rollings, and harrowings. When the requisite degree of fineness has been obtained, the surface should be rolled down in order to render it sufficiently compact and even to prevent the seed, which should always be sown in lines to admit of after-cultivation, from being buried too deeply; in fact I think that half an inch deep is amply sufficient for so small a seed, and, were it not that the sun is, whenever it appears, so powerful, scorching, and destructive to young plants, I believe that it might be sown on the surface and only covered, as clover is, with a brush harrow.

System described.

57. It will be seen that I avoid all mention of the number of times the land must be ploughed, harrowed, &c., for that must be judged by the individual cultivator himself and depends altogether on circumstances; however as some sort of guide, but with the reservation already made, I give below an estimate for the preparation of an acre of land for indigo :—

	Rs.	A.	P.
Deep ploughing (9—10 inches)	2	8	0
Scarifying (twice)	1	6	0
Harrowing	0	2	0
Ploughing	1	0	0
Harrowing and weeding	1	2	0
Rolling	0	3	0
Sowing by drill	0	4	0
Cost of preparation of land and sowing, Rupees ...	6	9	0

It will be noticed that this estimate is in excess of the actual figures, given in the table in paragraph 33, of the crop now growing in field No. 16, but the case there recorded is not perhaps a perfectly fair average one regarding the cost of preparation of the soil.

58. From 10—15 lb. of seed per acre should be sown, but even less will do if the seed is of first-rate quality, and than indigo, there is perhaps no crop the seed for which should be more carefully tested with regard to its vitality. Fresh seed carefully harvested from the *first growth*, not the last as is the common practice in this country, should always be used. In some cases it may be useful to steep it before sowing.

Seed required.

59. Having sown the seed with every precaution to ensure its early and equal germination, the appearance of the plant above ground must be awaited; this is perhaps the most anxious period of the crop's existence, for should heavy rain fall in

After-cultivation.

all probability the sowing will be lost, even if the germs have penetrated the surface. Should however success reward the endeavours of the cultivator, and the plant come up evenly over the whole field, nothing can be done until it has grown to such a size as will enable the lines to be discerned; to expedite this, if there be any superabundance of grass in the field, I have found it useful to turn a flock of sheep in, which will graze down the grass leaving the young indigo intact, and thus allowing the bullock-hoes to be admitted some days earlier than otherwise. Following in the wake of the bullock-hoes, hand-hoes should be kept constantly at work, and when their work is finished in all probability, unless the land be in a very foul state, the field can be left until the crop is ready to yield its first cutting.

Cost of growing.

60. If the sowing takes place at about the middle of November the crop will be ready for cutting by the beginning of March; taking the cost of cutting at Rupee 1 per acre, the cost of the crop up to that point will be—

	RS.	A.	P.
Preparation of soil and sowing	6	9	0
Bullock-hoeing	0	12	0
Hand-hoeing	1	4	0
Cutting	1	0	0
Seed	0	12	0
Rupees ...	10	5	0

To this should be added one-third of the cost of the manure applied to the preceding crop, at the rate of say Rupees 12 per acre, which would bring the grand total cost up to Rupees 14-5-0 per acre.

Probable yield.

61. The first cutting may yield about 60* bundles, worth Rupees 8-8-0 per acre at the price now ruling in this neighbourhood for green indigo, leaving a balance against the crop of Rupees 5-13-0 to be cleared off by the sale of the second and the third cuttings; to this however should be added the cost of a bullock-hoeing and hand-hoeing before each cutting, and the harvesting expenses, amounting in all to about Rupees 4 or in all Rupees 9-13. The second cutting is usually the heaviest and may be taken at 80 bundles, whilst the third and last may equal the first, making altogether 140 bundles worth Rupees 20, so that Rupees 10-3 per acre may be taken as the net return, from which the grower has to meet rent, interest on capital and profit.

Great profit of manufacturer.

62. That the profits which find their way into the hands of the cultivator should be so small from indigo is one of the results of the pernicious system of giving advances which prevails throughout the country and which reduces the ryot who takes them to a position little better than that of a bond slave; he becomes irretrievably involved in debt and must then take whatever terms his creditor, the manufacturer, sees fit to offer him. I have been credibly informed that from every 100 bundles of well grown indigo one maund of dye may be obtained, that is two maunds on a crop of 200 bundles per acre. The expenses of working a small vat, which will hold about 50 bundles, do not amount to Rupees 30 per mensem, including charges for interest on capital, wear and tear of plant, &c., or Rupees 2 per maund of dye prepared when in regular work.

63. The market value of indigo dye is about Rupees 45 per maund, so that the balance sheet of the manufacturer may be shown to be somewhat as follows:—

	RS.	A.	P.		RS.	A.	P.
To cost of 100 bundles of green indigo	14	4	7	By sale of 1 maund dye ...	45	0	0
,, cost of manufacture ...	2	0	0				
,, profit	28	11	5				
Rupees ...	45	0	0	Rupees ...	45	0	0

* The bundle here referred to, as elsewhere in the report, is one measured by a seven-foot chain.

Nearly Rupees 29 per maund or over Rupees 57-6 per acre, that is, nearly six times the profit which the producer receives and with a tithe of the risk.

64. A crop of indigo, yielding 200 bundles per acre will weigh about 12,000 lb.; this amount of valuable organic substance can be recovered *in toto*, for use as manure from the vat after the dye has been extracted; estimating this to be worth Rupees 3 per ton, we should get per acre manure of the total value of about Rupees 17, and thus indigo would become a restorative crop, and not as it is now, where the plant is wasted, one of the most exhausting grown by the ryot. It is the custom on this farm to supply carts for the removal of the indigo to the vat, on a payment of Annas 5 per cart with the proviso that the cart shall return laden with the refuse; as this work does not occupy a full day, the cost of the indigo per load (about 1,800 lb.) is 5 As.; deducting at this rate from the total value of the manure, a balance of nearly Rupees 15 per acre accrues to us in the shape of compost. But the valuable characteristics of the indigo crop do not alone consist in the valuable compost it gives, for the roots, &c., left in the soil after the last cutting form a most useful preparation for a cereal crop, which should be taken next. It will be said that it has been found that indigo is not so remunerative as I have shown, but I believe that such experiences result from the wasteful, irrational, and suicidal practices usually pursued, and until they are corrected indigo will continue to retain the evil character it at present possesses. There are risks attending its culture, but large profits may be expected from it, and these compensate for them.

Value of refuse as manure.

Value of crop in general husbandry.

65. The value of the water used in steeping the plant for irrigation purposes is great, for it contains a considerable amount of the soluble ash constituents of the plant and a considerable quantity of nitrogen.

66. Two experiments were commenced with a view to determine the best width apart at which to sow indigo, but owing to unfavorable circumstances, the results have not been as yet satisfactory, nor are they yet complete for the crop is still on the ground.

67. *Plantains.*—In September 1876, a plot measuring 1·68 acres was planted with plantains in rows 6 feet apart either way. I give below the cost of maintaining them up to the end of 1877, from which date the plantation may be said to have been in full bearing, although some bunches were received in the previous three months; the figures are as follows:—

Year.	——	Total.	Per Acre.
		Rs. A. P.	Rs. A. P.
1876	Planting	29 0 0	17 4 2
	Manure and Manuring	39 12 0	23 10 6
	Hoeing and Digging	17 6 0	10 4 3
	Watering	1 8 0	0 14 3
1877	Hoeing and Digging	34 14 0	20 12 2
	Watering	60 12 0	36 2 7
	Manure and Manuring	54 0 0	32 2 3
	Total ..	237 4 0	141 2 2
	Deduct value of 77 bunches and sundries received in 1877 ... .., ...	19 2 0	11 6 1
	Net cost of bringing into full bearing	218 2 0	129 12 1

The item for watering is perhaps lower than it would otherwise have been, owing to the cyclone rains in May, but the prolonged drought has so materially lowered our water-level that the cost of raising water for irrigation is greatly enhanced, and will remain so probably for some time to come.

68. The land on which the tope is situated is of very poor and varying quality, the greater portion being a coarse sand, and the remainder a sour stiffish loam, on which nothing has flourished, and on

History of crop.

which the plantains even are comparatively very stunted. The manure used was, for the first application in 1876, partly blood compost and partly poudrette, that for the dressing given in 1877—in September—chiefly blood compost, but box manure was also used for a few trees. Up to the end of 1877 the fruit yielded was of inferior quality, but since then, now that the last dressing of manure has acted, they have a flavor than which I have never noticed a better.

69. The cost of bringing the plantation into bearing has amounted to about 1·7 As. per tree, whilst they are worth at least 2 As.; but this must not be taken as the full value of the cropping, for on poor lands especially the liberal treatment and deep tillage adopted for plantains leads to a very great permanent improvement of the soil, in its condition and cleanness.

70. Since the 4th February 1878 the weight of the bunches received has been recorded, and the following statement shows the receipts and their value for five months:—

—	Number of Bunches.	Weight.	Value Received.
			RS. A. P.
January	79	Not registered.	17 1 6
February	18	180 lb.	4 11 0
March	34	463 „	9 13 6
April	98	1,384 „	22 14 0
May	26	262 „	4 12 9
Total ...	255	...	59 4 9
Total per Acre ...	152	...	35 4 9

The cost incurred between January 1st and June 1st has been as follows:—

—	Total.	Per Acre.
	RS. A. P.	RS. A. P.
Digging and hoeing ...	7 8 8	4 7 10
Watering	45 0 0	26 12 7
Total ...	52 8 8	31 4 5

So that Rupees 6-12-1 of the cost of bringing the plantation has been repaid. The trees standing on June 1st were valued at Rupees 312-8-0, leaving a balance of Rupees 101-2-1 in favor of the undertaking after 1 year and 9 months' existence.

Food produced.

71. The average weight of the bunches recorded is not large, but nevertheless, assuming the whole number received to have been about the same weight, the yield per acre in the months during which the plantation has been bearing, has amounted to between 2,500 and 2,600 lb. per acre. It was found by experiment that the yield of food (pulp) from the bunches was about 49 per cent. of their weight, so that the amount of food produced per acre was about 1,250 lb.

72. *Manilla Hemp* (Musa textilis).—Six shoots of this plant were received on the 30th of July 1877 from the Botanical Gardens, Calcutta; they were in good condition on arrival, and were put down in a good piece of soil and carefully attended to, but, excepting one, all have died off, and the surviving one* has made little or no growth since its arrival. The question of the adaptability of the plant to this climate has been the subject of a special report, so needs no reference here.

73. *Sorghum as a Sugar Crop.*—Besides producing large quantities of valuable fodder, Sorghum saccharatum is extensively cultivated in America as a regular sugar crop.

* This plant has also since died off.

The industry has grown to be a very important one and is supplanting that of the growth of sugarcane, especially in the more temperate States. Were it not for certain difficulties in the purification of the syrup, which must be thoroughly accomplished before sugar can be made, the crop would long ago have been much more extensively cultivated than it is. Attaining maturity in about 3 months, it will yield 8 tons of prepared canes per acre on land like that of this farm; it also possesses in a marked degree the power of rattooning, so that under irrigation probably three crops could be obtained annually from the same land, yielding a total of 20 tons of canes per acre and at an expense far below that required to grow the ordinary sugarcane. In the preparation of sugar from sorghum, special arrangements for evaporating, precipitating the impurities of the juice, and filtration are required; these are not expensive, and although I must state that I failed in an attempt to make some during the past year, I do not see that with proper apparatus there should be much difficulty in the manufacture.

Very valuable crop.

I had no proper crushing mill, no evaporating range, and what was of more consequence no experience in the working of it; unless the required knowledge could be obtained otherwise it must be gained by experiment alone. As bearing on the point I give here the analysis of good American sugarcane and sorghum compared:—

Difficulties of experiment.

—		Sugar.	Woody Fibre, &c.	Water.	Total.
Sugarcane	Dupney ...	17·8	10·2	72·0	100
	Peligot ...	18·0	9·9	72·1	100
Sorghum	Smith ...	12·0	12·4	75·6	100
	Stewart ...	14·5	12·5	73·0	100

74. I also give the following figures showing the composition of the juice of both plants:—

—	Sugarcane.	Sorghum.
Sugar	18·3	16·0
Organic matter and salts ...	·48	1·6
Water	81·22	82·4
Total ...	100	100

It is rare however that more than 50—60 per cent. of the juice of sugarcane is extracted from the canes with the best mills, although perhaps in some cases as far as 70 per cent. may be obtained; sorghum canes being of softer texture crush easier, and therefore it should be possible to extract a higher percentage of the valuable juice.

75. *Guinea Grass* (Panicum jumentorium).—The usefulness of this grass has often been referred to in these reports, but the past year of drought was such as tested the power of this most valuable forage plant to resist drought to the utmost, and it came out of the trial triumphant. A field of Guinea grass, about 2 acres in extent, planted in September 1875, was towards the beginning of May as brown and as dry as if it were totally devoid of life; the heavy rains in that month, however, led to its immediate revival, and, before the third day of rain was over, green shoots had appeared throughout the field, which grew on and produced a good crop of fodder in two months that weighed green 5,566 lb; this was followed by another cutting of 4,564 lb. of dry fodder, equal to about 12,000 lb. green, two months later. Not one per cent. of the tufts failed to throw out shoots after the rain referred to, thus showing that the plant is capable of withstanding our longest droughts.

Power of resisting drought.

76. *Prickly Comfrey* (Symphytum asperrimum) was referred to very fully in the report for the year 1875-76, and small experiments with the plant bear out the opinion that "it has little if anything to recommend it for cultivation as a forage plant in the plains of Southern India." It requires a deep, rich, moist soil under shade, and where these requisites can be secured may perhaps be grown with some success, whilst our ordinary forage crops will yield good returns under much more unfavorable conditions, as has been repeatedly shown in the many results obtained on this farm.

Uselessness in the plains.

77. *Tobacco.*—A series of experiments in the growth and curing of tobacco are being carried out under Mr. Schiffmayer's management, the results of which will, when complete, be embodied in a separate report.

78. *Buffalo Grass.*—The grass, referred to in paragraphs 173 to 178 of the report for 1875-76, continues to grow fairly, but sufficient roots have not as yet been obtained to make a fair experiment with it; it is still being kept under partial shade and is occasionally watered.

SECTION III.

MANURES.

79. *Manuring*—is carried on either to enhance or preserve the natural fertility of the soil, and the substances applied as manures all act either mechanically or chemically. It is well known that a crop grown on the land extracts from it certain mineral and nitrogenous substances required for its nutriment, and, if the crop be permanently removed from the land, the amount of such substances contained in the produce is lost to it. The capacity of the soil for furnishing plant-food being limited, in the end, if cropping without returning anything to the soil, as is usually practised on the unirrigated lands of this Presidency, be continued, exhaustion must ensue. It has been abundantly proved however by Messrs. Lawes and Gilbert, at Rothamstead, that, when a soil is left unmanured for some years and at the same time cropped, the annual productive power of it is reduced to so low a figure that ultimate exhaustion may be deferred for a very great length of time. The soil thus, as it were, possesses a power of protecting itself from the rapacious greed of the cultivator, for although it may contain abundance of the elements necessary for the support of plant life, these being in a presently unavailable condition, are only yielded up slowly in driblets as they become soluble.

Object and action of manuring.

80. Some manures act both by adding to the plant-food of the soil and by improving its mechanical condition, amongst such may be mentioned, farm-yard manure, composts, lime, burnt clay, &c.; other manures again are only mechanical in their action, as for instance sand when applied to a clay; the last great class of fertilizing substances is that which contributes only to the increase of those substances which the plant requires for its growth. Manures may be applied with a view to their present or ultimate effect, for instance a top-dressing of saltpetre might be given to a cereal crop which was not looking healthy with a view to stimulate its growth, but bones would be used as a dressing to add to the material condition of the soil. Some crops again prefer a rich upper layer of soil, others seek for all their food deeply; for the latter manure must be applied before sowing and covered in, for the former top-dressing will probably be as efficacious a manner of manuring as possible.

Classification of manures.

81. *Manuring Experiments.*—During the year under report it was impossible, owing to the extensive works of estate improvement which were being carried out, to form any definite scheme for experimental investigation which could be followed; as these works have been nearly completed, the difficulties of working on unprepared ground, which have retarded the

Delays explained.

work of the farm heretofore, will disappear, and in the future, as I mentioned in the report for last year, it may be possible to prosecute enquiries regarding the value of agricultural practices, not as yet fairly tried in this country, with more hope of recording facts whereon trustworthy foundation may be made in pointing out the way for agriculturists to follow than was formerly possible.

Improvement effected in farm soil.

82. The only point which at all redeems the great poverty of our soils, as shown by the analysis of one of the best of them, given in the report for the year 1873-74, which I reproduce below, is the fact that from their nature the extensive levellings and alterations of the surface which have been necessary will not cause a detrimental effect for any considerable length of time. The following is the analysis; and it speaks volumes for the value of good culture and high manuring, that such land should be brought to produce crops, such as have already been recorded :—

	Per cent.
Alumina	3·24
Oxide of iron	1·45
Phosphate of lime	·12
Carbonate of lime	·31
Sulphate of lime	trace only.
Carbonate of magnesia	trace only.
Chlorides	·90
Moisture	2·09
Organic matter	2·12
Sand	89·87
Total	100·00

83. At page 39 of the report for the year 1873-74, a table showing the Revenue Settlement valuation of the farm is given, this gives the rent at an average rate of Rupees 1-10-0 per acre, which figure would show that the gross outturn per acre was not then estimated as exceeding in value Rupees 9-14-0 per acre.

84. *Green Manuring.*—In the report of this farm for the year 1875-76, reference was made to the suitability of horse-gram (*Dolichos uniflorus*) for growth as a green manure. In several fields crops were ploughed-in during the past season, and although it is not possible to state what actual value the proceeding has, for no experiments were made, yet estimating the value of such a manure at Rupees 4 per ton it was necessary to produce about 4,500 lb. per acre to cover the cost of growing it.

85. The action of green manuring is two-fold. First, the substance of the plant decaying in the soil leaves behind a large quantity of prepared food, ready for absorption by the roots of the succeeding crop; secondly, when ploughed-in the structures of the green crop add directly to the amount of organic matters in the soil, and thus improve its mechanical condition, increasing its power of absorbing and retaining moisture, and increasing in the case of stiff soils their friability.

86. Leguminous crops ploughed-in green are an especially good preparation for cereals, owing to the very high percentage of nitrogenized substances which they always contain. I am however inclined to believe, from the results of the effects on a crop of sorghum grown in a field green-manured during the past year with horse-gram, that on light soils it will not be advisable to sow high standing cereal crops immediately after ploughing in the manure, for, judging from the case referred to, the presence of sufficient plant-food for the nourishment of the plant at, or very near the surface, possibly checks the tendency of the roots to penetrate deeply into the soil, and the consequence is that the plants are but insecurely fixed in the soil, and thus being easily laid by the wind a considerable loss of crop may ensue. It must however be remembered that my experience on this point is very limited, and I may see reason to alter the opinion I now express when I have seen more of the effects of the practice, beneficial or otherwise.

87. *Top-dressings.*—The field, in which the experiments, the results of which are recorded below, were made, is No. 13 on the Planter's friend crop already

referred to in paragraph 22, where the general cultivation is noted. In the centre portion of the field 24 plots each of one-twelfth acre in area were marked down, 12 on the western and 12 on the eastern side of the field; those on the east being denominated series B, in the first few plots of which a very sandy description of soil, differing greatly from the rest of the field, prevails, this is at the southern end. The soil on which the A series was situated is of far more even quality, and it is to these plots rather that we must look for reliable information.

History and description of manuring.

The top-dressings were all applied on the 12th October, and immediately afterwards the bullock-hoes were put into the field in order to mix the manures with the soil and prevent their being washed away by any showers; on October 14th there was a slight fall of rain, ·2 inch, which was probably of great value in dissolving, whilst at the same time it did not wash out the soluble manures; thus for the saltpetre and common salt applied the circumstances were as favourable as could be wished, but for the different applications of oil-cake, &c., probably it would have been more advantageous had the land been in a more saturated condition. It will be observed that up to the 29th October none but very light showers fell, and that during the total period of growth after the application of the manures 29·77 inches of rain were registered on 12 days. Shortly before harvest a few spots of rust appeared in the field—on the lighter soil generally first—and the grain was attacked by some disease which in its appearance, on casual examination, somewhat resembled the ergot which attacks cereals in Europe; to the last attack the deficiency of grain must be attributed.

88. The results were as follows:—

Manure applied per Acre.			Yield per Plot.				Yield per Acre.				Increase or Decrease per Acre.				Value of Crop per Acre.		Percentage of Loss on drying Straw for 17 days.
			A.		B.		A.		B.		A.		B.				
Weight in Pounds.	Description.	Value.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	A.	B.	
		RS.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	RS. A. P.	RS. A. P.	
...	Nothing	...	1,414	16¾	506	5¾	16,968	201	6,072	69	...	...	...	...	64 9 7	23 0 0	37
180	Saltpetre	12	1,918	23½	784	9	23,016	279	9,408	108	6,048	78	3,336	39	87 14 0	35 10 10	28
90 372	Saltpetre ... ... White Castor-oil cake ...	12	1,524	23¾	980	8½	18,288	285	11,760	102	1,320	84	5,688	33	72 5 9	43 4 5	36
90 372	Saltpetre ... ... Bone charcoal	12	1,379	11¾	1,092	12	16,548	141	13,104	144	— 420	— 60	7,032	75	—60 12 10	49 7 0	36
60 252 252	Saltpetre ... ... Bone charcoal ... ... White Castor-oil cake...	12	1,792	8	1,148	9¼	21,504	96	13,736	111	4,536	—105	7,664	42	75 8 3	50 8 7	37
90 189	Saltpetre ... ... Common salt	12	1,729	10	1,090	9¾	20,748	120	13,080	117	3,780	— 81	7,008	48	73 15 4	48 4 5	21¼
378	Common salt	12	1,372	10¼	1,008	11¼	16,464	123	12,096	135	— 504	— 78	6,024	66	59 12 9	45 11 6	29¼
744	Bone charcoal	12	1,470	12¼	1,090	11	17,640	147	13,080	132	672	— 54	7,008	63	64 10 10	48 14 0	30
372 426	Bone charcoal ... ... Old Oil-cake fresh ...	12	1,295	10¾	1,456	14½	15,540	129	17,472	174	1,428	— 72	11,400	105	56 15 2	65 3 2	36¾
372 426	Bone charcoal ... ... Old Oil-cake decomposed.	12	1,480	12¾	1,568	10½	17,760	153	18,816	126	792	— 48	12,744	57	65 5 1	67 12 4	37
744	White Castor-oil cake ...	12	1,624	10¾	1,176	17	19,488	129	14,112	204	2,520	— 72	8,040	135	40 1 10	55 3 1	Not taken.
1,488	Oil seed husks	12	1,064	13¾	1,372	10¼	12,768	165	16,464	123	—4,200	— 36	10,392	54	49 2 6	59 12 9	37
															64 3 8	51 12 3	

Average value of produce of 11 manured plots ...

Description of manures.

Looking at the A series alone, we see that saltpetre gave by far the best results, the application being rather a heavy one; the lowest yield in the series was given where castor-oil seed husks had been applied, this is not surprising considering the character of the manure which, although it is probably very rich in ash constituents, from its nature will take a considerable time in decomposing; the white castor-oil cake is composed of the kernel of the castor-oil bean, and consists chiefly of carbonaceous and some nitrogenous matters, and although the former would improve the texture of the soil, the only active fertilizing substances are the latter. These experiments seem to show that, for this crop on our land, common salt is not of much, if of any, value; mixed with saltpetre in equal values it did not yield as much as half the increase a full dressing of the saltpetre did, whilst alone there was no increase observable. These experiments require to be repeated and amplified before the full value of the results here recorded can be appreciated.

Less on drying straw.

89. The figures in the last column of the table show the percentage decrease on drying the straw, received from the several plots, in the open air for 17 days; they are the first of the sort recorded in India, I believe, and, although open to the same doubts as all such experiments are, they give some facts from which in the future, when more information has been collected, it may be possible to deduce certain rules for the guidance of beginners in the use of manures. It is well known that some manures induce plants to produce more succulent forage than others, and in estimating the value of forage grown with different manures these characteristics must be taken into consideration.

Reason for making experiment.

90. *Bone Charcoal.*—Owing to the composition of this substance, the extremely valuable fertilizing substances which it contains, chiefly phosphate of lime, are not of much immediate use to the crops to which it may be applied; this is amply proved by field experiments in its use. With the idea that by mixing it with decaying organic matters some portion of it might be rendered soluble by the action of the acids and heat generated in the process of decomposition, several experiments, the results of which are recorded below, were made during the past season. It is however difficult to say whether the increase which is shown to have been obtained by use of cake and bone charcoal mixed some time before application is due to the partial decomposition of the cake or to any dissolution of the constituents of the charcoal; this point will require further examination, but the work done is so far useful that it is a step towards the solution of the question; more carefully designed experiments will be possible in future, but nevertheless the record of facts, not results, is what is the aim of experimental farming, and some valuable ones are here noted:—

1	Crop and Field Number.	Yellow Cholum. No. 31.		Planter's friend. No. 13.		Maize. No. 10.		Sumba Paddy. No. 35, Plot II.	
2	Manure per Acre ...	330 lb. Bone charcoal. 380 lb. Cake. Freshly mixed.	330 lb. Bone charcoal. 380 lb. Cake. Mixed before and allowed to decompose.	372 lb. Bone charcoal. 426 lb. Cake. Freshly mixed.	372 lb. Bone charcoal. 426 lb. Cake. Mixed before and allowed to decompose.	372 lb. Bone charcoal. 426 lb. Cake. Freshly mixed.	372 lb. Bone charcoal. 426 lb. Cake. Mixed before and allowed to decompose.	1,333 lb. fresh Cake.	599 lb. Bone charcoal. 734 lb. Cake. Mixed before and allowed to decompose.
3	Area of Plot in Acres ...	·655	·655	·16	·16	·16	·16	·3	·3
4	Yield per Plot — Straw.	LB. 3,517	LB. 3,685	LB. 2,760	LB. 3,058	LB. 506	LB. 408	LB. 1,145	LB. 1,337
5	Yield per Plot — Grain.	10½	10¾	25½	23	296*	236*	267	227
6	Yield per Acre — Straw.	5,369	5,626	16,500	18,348	3,036	2,448	3,816	4,456
7	Yield per Acre — Grain.	16	16	150	138	1,776*	1,416*	896	756

* Cobs.

91. The yellow cholum crop was sown on October 4th, 1877, and the manure was applied when the crop was about 6 inches in height on the 16th of the same month; it was harvested on 11th January 1878, having been on the ground 99 days, during which 30·13 inches of rain fell in 29 days, of this 29·27 inches in 27 days were registered after the application of the manure. The soil of the field is for the most part a light sandy loam, but, being rather steeply inclined, is exposed to considerable surface wash. The Planter's friend field has already been referred to in paragraphs 22 and 87, where all particulars regarding the crop are given. The maize crop was sown in a field only recently levelled, and the results obtained in it are therefore open to great doubt owing to the uneven quality of soil, and they are further in a measure vitiated as regards the weight of cobs obtained by the number stolen from the field before harvest. The crop was sown on September 24th and was 89 days on the ground; the manure was applied on the 14th October, and out of the total rainfall 32·22 inches in 34 days, which the crop received, 29·47 inches fell in 28 days after that date.

Details of crop.

92. *Saltpetre.*—The well known value of this substance as a manure for cereals, together with the comparative ease and moderate price at which it can be obtained, should lead to its general use in this country now that no demand exists for it for export. Provided that the crude saltpetre is only tolerably pure, containing not less than 75 per cent. of potassum nitrate, and if it can be purchased at a price anything like Rupees 90 per ton, its use should prove remunerative. The saltpetre used during the past season was purchased in Coimbatore, and after paying all charges was delivered at Sydapet at the rate of about 15 lb. per rupee. The sample was fairly pure, as far as a rough examination would show, but it contained a rather large amount of moisture, which greatly enhanced its price. Several experiments were made with it as a top-dressing in different amounts, with a view to determine the most profitable rate at which to apply it, but owing to the character of the season, these were not satisfactory; in the following table however the results obtained with a crop of sorghum are given:—

Utility and value.

—		Unmanured.	60 lb. Saltpetre per Acre.	90 lb. Saltpetre per Acre.	120 lb. Saltpetre per Acre.
Yield per Plot	Straw ...	LB. 4,437	LB. 4,364	LB. 4,514	LB. 5,296
	Grain ...	167	208	490	160
Do. per Acre	Straw ...	8,874	8,728	9,028	10,592
	Grain ...	334	411	380	320
	Value ...	RS. A. P. 42 15 0	RS. A. P. 42 3 2	RS. A. P. 45 4 8	RS. A. P. 48 1 8

This crop was sown rather late but came up extremely well. The land had been manured by ploughing in a crop of horse-gram, but no great depth of cultivation was attained. The soil is rather light and sandy and on that account not likely to give great returns from the use of saltpetre. The weather also after the application of the top-dressings was not at all advantageous, for, after December 11th, the date on which they were applied, only ·51 inches of rain fell during the remaining period of the growth of the crop, an amount perfectly inadequate to bring out the full action of saltpetre.

History of crop.

93. *Effect of Manure on the Second Crop.*—In paragraphs 77—83 inclusive of the last report, some top-dressing experiments, made in field No. 32, with a crop of yellow cholum, were referred to; with a view to determine whether the power of the manures applied then continues to show itself in the second year, the outturns obtained from the succeeding crop of indigo have been recorded and will when complete be given in the next report.

SECTION IV.

LIVE STOCK.

94. *Stock-breeding Experiment.*—This has again been delayed owing to the non-removal of the Commissariat slaughter-houses; had this long-delayed event occurred, arrangements might have been made for obtaining some good stock from Australia as a nucleus for future operations. It is hoped that during the coming year the new slaughter-house will be erected, after which a start may perhaps be made. The cattle obtained from the Amrhut Mahal have on further knowledge only confirmed the bad opinion of them originally formed.

Again delayed for want of accommodation.

95. *Housing.*—It is only such an occurrence as the cyclone, which did so much damage in this neighbourhood in May last, that enables the great value of proper shelter for live stock, to be fully seen and appreciated. Although it is only at exceptional times that the special value is shown, the general utility of adequate housing is undoubtedly to be found in the general condition and health of all stock so treated. Nothing perhaps, in this country, so much favors the spread of contagious and infectious diseases, as the want of attention to the requirements of live stock, and as long as the diseases are allowed to ravage the herds of the country unchecked, it can scarcely be expected that the ryot will endeavour to improve his stock. It may be said that feeding has more to do with the improvement of our live stock than anything; no doubt it has, but unless more care in other respects be also taken of them, feeding alone cannot do much, and cannot avert such a catastrophe as happened to the Sydapet Taluq in May 1877, when 11,687 cattle and 7,218 sheep were destroyed; these may be taken to have been of an aggregate value of nearly 2 lakhs of rupees, £20,000. In the Revenue Settlement Report of the taluq, submitted by Mr. Banbury in April 1874, it is stated that the number of ploughing and milch cattle in it amounted to 28,316, and the number of sheep and goats to 16,929; the loss therefore amounted to 41 per cent. of the former and 43 per cent. of the latter; no doubt the terribly reduced condition of the stock caused them to succumb in such numbers, but had they been protected from the rain and chill consequent on their exposure, the loss would have been trifling. On this farm in a stock of 31 cattle we did not lose one; and out of three hundred sheep 3 or 4 only died, probably from the effects of the weather.

Ill-effects of ordinary treatment of stock.

Enormous loss in Sydapet Taluq last May.

96. Not only should cattle be housed for their own sake, but, in order to preserve the manure made by them from the effects of exposure to the weather, shelter is imperatively necessary. For making the best manure and at the same time having adequate regard for the health of the stock, loose boxes are best adapted. Experience on this farm has amply proved the utility and feasibility of the system, whilst, for economic conservation of the manure, boxes have long held the first place.

Value of shelter in preserving manure.

97. The necessity for the improvement of the milch and draught cattle of the country cannot be denied, but it can never take place until the practice of using any bull as a sire is put a stop to; this cannot, at present be effected except by the interference of the State, and it is a matter of such great importance that the feasibility of any plan for only allowing the use of licensed sires might be considered. To carry out such a plan would not be difficult, for all bulls unless licensed might be castrated by Government; all licensed animals might easily be branded, numbered and registered. The best animals only would be kept, and in time the effect of such a restriction would show itself, and when the people had, by means of pressure, been brought

System of use of licensed sires only suggested.

to understand the value of good they would cease to keep bad sires, and the necessity for licenses would disappear. A muster of all the herds once in two years before a competent person would be sufficient to prevent evasion. The rate for licenses might be fixed at such an amount as would cover the expenses of working the system.

98. *The working of Cows.*—There are in this Presidency, according to the latest statistics, about $8\frac{1}{4}$ million head of cattle; of these it may be fairly assumed that at least two millions are cows and heifers above two years of age. It is surprising, at a time when such general complaint has been made of want of sufficient stock for the performance of agricultural operations, that the native has not so far been led by the pressure of circumstances to leave the beaten track as to make use of the enormous surplus power lying idly by his side. That the native really objects for any good reason to the use of cows as draught animals, I doubt; for during the past year I had no difficulty at all in inducing my coolies to train and use the cows of the Amrhut Mahal breed, and although in this case the success of the training was not altogether of a very satisfactory character, owing to the wildness of the cows dealt with, it showed that it is possible to make our cows do something for their keep during that portion of the year when they are not milking. It can scarcely be disputed, that the ordinary country cow seldom remains in milk more than six or that she comes into milk oftener than once in 18 months, so that for a very long period—nearly 9 months annually—her labor might be made use of; if in the hot weather, in raising water for the growth of green crops for the better feeding of herself and her fellows; if in the cultivating season, by aiding in the ordinary agricultural operations going on at that time. It may not, it is true, be advisable to work cows as hard as ordinary draught cattle, but by working them lightly, 500,000 head of cattle, or from 10—15 per cent. might be added to the cultivating force of the country as it at present stands. There are no objections to be raised against such a practice in the interests of the cow; it would rather in fact be for her advantage; the moderate exercise entailed thereby and the extra food given her being likely to keep her in better bodily condition and in better health. The experience of several European countries justifies this conclusion.

Great present waste of power.

Great possible increase of ploughing force.

99. *Aden Cattle.*—At paragraph 63 of the report for 1874-75, it was observed that the cow of this breed imported in 1874 had shown herself to be a tolerable milker, from having been able to rear two calves together. Since that notice she has calved twice, but on the first occasion it was not possible to test her milking powers, as I was not then in residence on the farm; last May however, when she calved the second time, I commenced on the fourth day after calving the experiment of which I give the records below. The statistics given show conclusively that she is a good milker, for she reared a calf besides yielding the amount of milk recorded. Although without a chemical analysis it is impossible to determine accurately the composition of milk, yet, that the milk was of an excellent quality the fact that one measure (106 cubic inches) of it yielded 3 oz. of butter proves conclusively. Such a yield is equal to 1 lb. of butter* from 16·3 pints of milk, which compares most favorably with that common in English dairies, where the best breeds only yield 1 lb. from 16—17 pints and the average is as low as 1 lb. from 22 pints. The treatment of the cow during the whole time that she was milking was the same; at night she was kept in a stable open to the north, and during the day was tethered out to graze, after being milked at 7 A.M., until she was required again at 5 P.M. for the same purpose. Whilst being milked her calf was always kept near her to quieten her, and it was only after the removal of all the milk that could be drawn by the milkman, allowed to strip her udder. In the month of October being in season she took the bull and was thus due to calve again in July; to her being in calf the rapid diminution of the milk in January (36th week) may be attributed. The cost of keeping the cow for twelve months may be put down as follows:—

Milk of first quality.

* The butter made probably contained more water than that made in England, hence the great yield.

	Rs.	A.	P.
10,800 lb. of fodder	36	0	0
1,440 lb. of oil cake	28	12	10
720 lb. of bran	14	6	5
Attendance and sundries	12	4	9
Or about Rupees 7-8-0 per mensem	91	8	0

The cow is a small one, as a reference to the table given in paragraph 88 of the last report shows; when those figures were collected she weighed only 490 lb. The total yield of milk was 832 measures 3 ollocks, which equals 2,542·2 pints; the measure used was discovered to be larger than the standard, when the experiment was nearly completed, so that the number of pints here recorded is the safest guide, the error in the size of measures having been allowed for.

100. The following table gives the weekly registrations, commencing from May 4th, 1877:—

—	Morning.		Evening.		Total.			—	Morning.		Evening.		Total.		
	Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks.	Pints.		Mrs.	Olks.	Mrs.	Olks.	Mrs.	Olks.	Pints.
1st Week ...	8	2	4	7	13	1	40·1	25th Week.	12	1	11	1	23	2	71·0
2nd „ ...	7	4½	6	1	13	5½	41·8	26th „ ...	10	1	9	2	19	3	59·2
3rd „ ...	7	1	7	1	14	2	43·5	27th „ ...	10	4	9	5	20	1	61·5
4th „ ...	7	2	7	7	15	1	46·2	28th „ ...	10	6	9	3	20	11	61·5
1st Month...	30	1½	26	0	56	1½	171·6	7th Month...	43	4	39	3	82	7	253·2
5th Week ...	8	3	8	0	16	3	50·0	29th Week.	11	5	9	2	20	7	63·7
6th „ ...	8	6	8	6	17	4	53·4	30th „ ...	12	0	9	0	21	0	64·2
7th „ ...	8	6	8	6	17	4	53·4	31st „ ...	16	0½	4	1	20	1½	61·7
8th „ ...	8	6	8	6	17	4	53·4	32nd „ ...	14	2	7	6	22	0	67·3
2nd Month...	34	5	34	2	68	7	210·2	8th Month...	53	7½	30	1	84	0½	256·9
9th Week ...	8	6	8	6	17	4	53·4	33rd Week.	11	4	7	4	19	0	58·1
10th „ ...	8	6	8	6	17	4	53·4	34th „ ...	11	2	9	6½	21	0½	64·3
11th „ ...	8	6	8	6	17	4	53·4	35th „ ...	10	6	10	2	21	0	64·2
12th „ ...	9	6	9	6	19	4	59·6	36th „ ...	9	2	7	4	16	6	51·1
3rd Month...	36	0	36	0	72	0	219·8	9th Month...	42	6	35	0½	77	6½	237·7
13th Week...	9	7	9	1	19	0	58·1	37th Week.	10	2	6	4½	16	6½	51·3
14th „ ...	9	6	5	4	15	2	46·6	38th „ ...	10	2½	6	4	16	6½	51·3
15th „ ...	11	4	7	4	19	0	58·1	39th „ ...	8	4½	7	3½	16	0	48·9
16th „ ...	11	2	9	1	20	3	62·2	40th „ ...	8	7	5	5½	14	4½	44·4
4th Month...	42	3	31	2	73	5	225·0	10th Month.	38	0	26	1½	64	1½	195·9
17th Week.	11	3	10	4	21	7	66·8	41st Week.	9	2	5	7½	15	1½	46·4
18th „ ...	11	2	10	2	21	4	65·7	42nd „ ...	8	2	7	3½	15	5½	47·9
19th „ ...	10	5	10	2	20	7	63·7	43rd „ ...	8	1	7	3	15	4	47·3
20th „ ...	10	5	10	7	21	4	65·7	44th „ ...	6	5	5	7	12	4	38·2
5th Month...	43	7	41	7	85	6	261·9	11th Month.	32	2	26	5	58	7	179·8
21st Week...	11	7	11	2	23	1	70·7	45th Week.	2	1	5	7	8	0	24·4
22nd „ ...	11	4	10	7	22	3	68·4	46th „ ...	4	0	1	1	5	1	15·6
23rd „ ...	12	2	11	3	23	5	72·2	47th „ ...	0	7	1	0	1	7	5·6
24th „ ...	12	2	11	3	23	5	72·2	48th „ ...	0	1½	0	1½	0	3	1·1
6th Month...	47	7	44	7	92	6	283·5	12th Month.	7	1½	8	1½	15	3	46·7

101. This may be summarised as follows :—

	MRS.	OLKS.	PINTS.
1st Month	56	1½	171·6
2nd „	68	7	210·2
3rd „	72	0	219·8
4th „	73	5	225·0
5th „	85	6	261·9
6th „	92	6	283·5
7th „	82	7	253·2
8th „	*84	0½	256·9
9th „	77	6½	237·7
10th „	64	1½	195·9
11th „	58	7	179·8
12th „	15	3	46·7
Total ...	832	3	2,542·2

Considering the size of the cow, this yield is better than that recorded from a cross-bred Devon-Nellore, in paragraphs 33—37 of the report for 1875-76, being equal to 318 gallons.

102. *Sheep.*—The system of managing the flock continues the same; during the day, excepting from 11—2, it is grazed over the fields, &c., and at night it is confined under cover, where every precaution is taken to preserve the excreta by the use of sand and dry earth. The manure thus collected is very valuable, and although at certain times of the year it would no doubt be advantageous to fold the flock on the fields, to graze down a green crop and to manure the land at the same time, yet it will always be advisable to shelter it during the rains, and during the dry weather folding would simply mean throwing the manure away. The following table is a continuation of that given last year, at paragraph 93 of the report; it shows a very high death-rate, not I believe due to the character of the year, but to the fact that we have had during the time an average flock of 75 rams and those are so disposed to fight that it is impossible to prevent their doing themselves fatal injuries. The rams were kept for distribution in the districts, but to have distributed them during the drought would have been folly, as they would in all probability have been starved. If we eliminate the rams, the percentage of deaths is very low, being only 4·54, or slightly above that of the previous year :—

High rate of mortality explained.

	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.
Average number of flock	207	221	237	275	295
Number of deaths	16	24	21	11	*31
Percentage of deaths	7·73	10·9	8·9	4	10·5
Rainfall in inches	48·07	68·98	38·14	20·88	65·55

103. *Mortality amongst Lambs.*—In the year 1874, coming as it did after an exceptionally wet December, the percentage of deaths during the first six months following the lambing season was rather high, reaching as far as 11·3; but in the following year 1875 this rate was far exceeded, for as many as 17·3 per cent. of the lambs were lost: the rains of 1874 were extremely heavy and may have been the reason for the terrible mortality shown. In the two following seasons the deficiency of rainfall appears to have had a beneficial effect in so far as the death-rate was reduced in 1876 to 8, and in 1877 to 8·4 per cent. Up to June 1st the loss this year has been only 2·8 per cent. of the lambs born, a most satisfactory improvement. The number of lambs born in the several seasons was as follows: in 1874 seventy-one; in 1875, seventy-five; in 1876, seventy-seven; in 1877, seventy-four; in 1878, seventy-one. Our lambing season usually commences at about the end of January,

* Of these 21 rams.

and it is intended always in future to place the ram with the ewes on the 1st of September, in order that, there being a regular recognised date for it, as little variation as possible may occur. When the lambs are dropped in February, the rank growth of grass, which the monsoon rains foster, is either grazed down or is so far dried as to be rendered harmless, and by the aid of some artificially grown green fodder—horse-gram or guinea grass—sufficiently succulent, and at the same time wholesome food is procurable for the ewes. An addition of a little bran to the food of the flock is extremely useful in promoting an increased flow of milk. As soon as they can be allowed to go out, the ewes and lambs may be run over the cholum stubbles with advantage, the young second growth being very suitable for them.

104. The following table is in continuation of that given last year, showing the weight and yield of wool of the various sections of the flock; the sheep were shorn at the beginning of May last, but the weighments were not made until July.

	1877.			1878.		
	Number.	Average Weight.	Yield of Wool.	Number.	Average Weight.	Yield of Wool.
		LB.	LB.		LB.	LB.
Rams—						
Lambs	38	28	Notshorn	28	38·6	Notshorn
Shearling	31	47	1·76	...	52·6	...
Other ages	39	68·06	2·08	...	73	...
Average	70	58·74	1·94	80	66·2	1·57
Ewes—						
Lambs	27	25·6	Notshorn	31	31	Notshorn
Shearling	34	39·6	1·6	35	45·6	1·8
Other ages	107	39·03	1·40	101	54·5	1·6
Average	141	49·05	1·45	136	52·2	1·65
Average sheep of all ages	211	52·27	1·62	216	57·4	1·62

The statistics given are neither so detailed, nor were they so carefully collected as those for 1877, but it is scarcely necessary to go into the question minutely every year; a periodical detailed examination of the condition of the flock will suffice. The greater yield of wool per head from the ewes, as well as the greater weight all round, are probably due to a better season, but the decreased yield of wool amongst the rams is unaccountable.

105. *Pigs*—have for the present been given up, and the stock which we had left has been sold off. When cattle are imported from Australia for the stock-breeding experiment, it will be advisable to procure some pigs at the same time.

SECTION V.

FOODS AND FEEDING.

106. The table which I give here is an interesting addition to the data we possess regarding the composition of our Indian pulses ; the samples analysed were purchased in the open bazaar and sent home to Professor Church of the Royal Agricultural College, Cirencester ; the figures given have been published in the "Agricultural Students' Gazette," from which I extract them as follows :—

Common Name ...	Dholl.	Green-gram.	Black-gram.	Mochecottay.	—	Horse-gram.	Corkapilly Seed.
Botanical Name ...	Cajanus Indicus.	Phaseolus Mungo.	Phaseolus Roxburghii.	Lablab vulgaris (Brown).	Lablab vulgaris (White).	Dolichos uniflorus.	Inga dulcis.
Moisture	13·30	10·80	10·10	14·60	14·30	11·00	13·50
Oil	2·60	2·65	2·15	2·25	2·20	1·95	17·05
Albuminoids	17·09	22·15	22·72	17·09	20·54	20·95	17·59
Starch and digestible carbo-hydrates.	55·73	54·20	55·83	57·51	53·51	56·72	41·55
Indigestible fibre ...	7·53	5·80	4·80	5·00	5·80	6·16	7·66
Ash	3·75	4·40	4·40	3·55	3·65	3·22	2·65
	100·00	100·00	100·00	100·00	100·00	100·00	100·00

These figures show horse-gram to be a poorer food than it is generally considered, and explain the value of black or green gram as an addition to rice, they being in this respect much superior to dholl both in the larger percentage of albuminoids they contain and by the fact that the amount of indigestible fibre in their composition is less. The amount of oil in corkapilly seed would probably be sufficient to repay extraction; this has, I believe, been in some measure tried, but I am unaware of the quality of the oil it yields.

107. Feeding experiments with the intention of producing meat are as yet uncalled for in this country, and I believe it would be only a waste of time to prosecute them to any great extent; it has been sufficiently proved that meat can be grown of good quality and at reasonable rates, but for the present, the demand for high class meat is not sufficient to call for any large enterprise in its production.

108. During the past year, owing to the excessive price of ground-nut-cake, we have been obliged to make use of other food, in order to supply our stock with a proper amount of artificial food in addition to their allowance of straw or chaff. A large quantity of damaged grain and sweepings were purchased from the Madras Railway Company, and after washing it carefully to remove the dirt, &c., it was turned into a most palatable food by boiling for some hours; the cattle ate it with avidity, and although it was probably too carbonaceous to be very well suited to them when hard worked, its use was the only means we had of feeding them properly without excessive expense. During the whole year no deficiency, for our own purposes, of straw and fodder was experienced, and the stackyard throughout the year presented an appearance totally incompatible with the presence of a famine of cattle food. Our stock was kept in working order, so that when the rain fell in May no delay occurred in getting our crops put in. It is very bad policy to stop a supply of artificial food during such an exceptional time, even though the expense incurred in supplying it be great; of course this demands the possession of capital amongst the cultivators, but unless a man can prove that he possesses a sufficiency of capital he should not be allowed to rent Government land.

Damaged grain found to be a good food.

SECTION VI.

IMPLEMENTS, MACHINES, &c.

109. During the year the only new machine experimented with was a grubber or scarifier, made on the farm on the same general plan as is followed at home; consisting of an iron frame, to which curved tines are attached, and supported on wheels, which, by being raised or lowered, render it possible either to transport the implement along the roads, or to regulate the depth at which it is working in the field. It takes two pair of bullocks to work this grubber, and it will do in a day work, which in its absence would necessitate the use of 3 ploughs, thereby effecting a decided economy, whilst in some cases the simple stirring of the surface is more desirable than the inversion of it, allowing the removal of weeds to be more thoroughly performed. The cost of this very valuable addition to our means of cultivation is about Rupees 65, not at all an excessive price considering the work it performs. The tines are fitted with both broad and narrow shares for use according to the work required to be done.

Grubber an economical implement.

110. The Double Mhote continues to be the most valuable and economical water-lift we possess; during the year the following models of it have been made, and distributed as shown, at the cost of the Farm:—South Arcot 2, Madura 1, Bangalore 2, Travancore 1, Kaira 1, and Deccan 1. The total number of models distributed in the last 3 years has been 16.

SECTION VII.

IMPLEMENT WORKSHOPS.

111. The following table shows the machines sold during the past year, and the destinations to which they have been sent:—

—	Iron ploughs.	American ploughs.	Iron Cultivator.	Drag harrow.	Drill Sowing Machine.	Planter's Hoe.	Hoe Fork.	Grubber.
Tinnevelly	...	...	...	...	1	...	...	...
Mysore	4	1	...	1	...	...	...	1
Hyderabad	1	1	1	...	...	1	1	...
Madura	...	1	...	...	...	...	...	...
Total ...	5	3	1	1	1	1	1	1

112. Since the commencement of the Workshops in 1870, the following implements have been sold by it, most of them having been manufactured in it: 52 iron ploughs, 11 American-pattern ploughs, 64 combined ploughs, 15 bullock hoes, 14 harrows of different sorts and 5 carts; 454 reaping knives, 35 scythes, 15 planter's hoes, 8 wheel hoes, a seed barrow and sundry other small tools.

113. The following statements show the transactions during, and the financial condition of the shops at the end of, the year:—

Statement of Income and Expenditure for the Year ending 31st March 1878.

Income.				Expenditure.			
	RS.	A.	P.		RS.	A.	P.
Machines	515	11	0	Carpenters, Smiths and Filer ...	858	5	3
Materials	339	4	1	Cooly Labor	203	4	6
Labor	995	14	7	Plant and Materials	839	0	8
Capital advanced	179	12	9	Interest	130	0	0
Total ...	2,030	10	5	Total ...	2,030	10	5

Balance Sheet of Implement Workshops on the 31st of March 1878.

Liabilities.						Assets.					
	RS.	A.	P.	RS.	A.	P.		RS.	A.	P.	RS. A. P.
Capital invested April 1st, 1877.	1,662	13	4				Valuation—				
Do. advanced during the year.	179	12	9				Buildings	451	3	4	
				1,842	10	1	Plant	214	8	0	
Laborers' pay due for March ...	...			70	13	3	Materials	185	1	1	
							Implements for sale.	364	8	0	
											1,215 4 5
							Outstanding bills ...	...			134 11 6
							Deficiency	...			563 7 5
Rupees ...	...			1,913	7	4	Rupees ...	...			1,913 7 4

SECTION VIII.

DISTRIBUTION OF SEEDS.

114. During the year under report the following seeds were distributed gratis, at the expense of the farm for packing and despatch, to the districts mentioned in the table :—

Districts.	Sorghum.	Planter's Friend.	Yellow Cholum.	White Cholum.	Maize.	Cotton Seed.	Carolina Paddy.	Sundries.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.
Madras	100	65	10	15	17	5	...	5
Chingleput	95	45	27	20	9	50	25	55
Madura	30	...	...	...	...	...	...	...
Nellore	10	10	...	...	...	...	...	...
Kurnool	55	30	...	...	...	...	...	...
Bellary	5	...	...	3	1	5	...	5
Vizagapatam ...	90	30	...	...	...	...	...	...
Ganjam	40	10	...	...	...	...	...	...
North Arcot ...	130	60	5	9	32	40	10	20
South Arcot ...	15	...	5	6	2	10	10	40
Trichinopoly ...	75	...	5	3	1	5	10	10
Coimbatore	10	...	...	...	1	12	25	19
Tinnevelly	100	100	...	...	...	20	...	...
South Canara ...	40	15	...	3	3	14	...	2
Travancore	10	10	...	...	...	...	...	...
Neilgherries ...	30	20	...	...	...	...	...	12
Mysore	...	...	...	...	...	25	...	...
Hydrabad	20	10	...	...	5	15	...	...
Bombay	20	5	5	3	3	21	10	5
Unknown	20	10	...	...	...	5	...	...
Total ...	895	420	57	62	74	227	90	173

115. The following is a table showing the total amount of seeds that have been distributed during the past 5 years :—

Years.	Maize.	Sorghum saccharatum.	Planter's Friend.	Yellow Cholum.	Carolina Paddy.	New Orleans Cotton Seed.	Sundries.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.
1872-73	301	402	...	35	90	683	...
1873-74	2,946	140	...	660	3,487¾	338	150
1874-75	145	69	...	55	285¼	127	...
1875-76	635	55	...	...	250	192½	...
1876-77	700	862¾	633½	15	335	320½	37 and 38 packets.
Total ...	4,727	1,528¾	633½	765	4,448	1,661	187 lb. and 38 packets.

SECTION IX.

ESTATE.

116. No change has been made in the area of the estate nor has the nuisance complained of in paragraph 137 of the last report been removed; it is hoped however, that during the coming year the new slaughter-houses will be erected, when the old ones will become available for use as cattle-yards, and it is intended to fence in the Roshunbaukum village as effectually as a small grant will allow, and when these two most desirable changes are effected the farm will be put on a footing such as should have been attained before experimental work was commenced at all.

Nuisance unlessened.

117. The annoyance and loss from petty pilfering in our fields has been very great; a set of experiments was ruined, besides great pecuniary loss being experienced in the same and in other fields of maize; we lose from time to time bunches of plantains from the plantation, and in numerous other instances great damage has been done. The peculiar situation of the buildings, and of the whole farm, favors the depredations and escape of thieves. One man taken in the act, one night at about 11 P.M., of stealing maize cobs was sentenced by a magistrate to one year's hard labor, but this did not check in any very marked degree the continual petty theft.

Petty pilfering causing serious loss.

118. *Casuarina Trees.*—The plantations of this tree, mixed with various fruit or hard wood trees, which have from time to time been planted on the poorer soils of the farm, have generally and are doing remarkably well, and constitute an annually increasing increment of value in the estate. Those trees planted in the latter end of 1876 have already, owing to the abundant use of manure, and care in watering them during the long drought of last year, attained in some cases the height of at least 20 feet. The cost of raising such a tope in ordinary seasons may be estimated per acre as follows :—

Valuable property.

	Rs.	A.	P.
Pitting	12	8	0
Planting	12	8	0
Plants	14	0	0
Manure	30	0	0
Watering 9 months	16	0	0
Rupees ...	85	0	0

This is for planting at the rate of about 1,200 trees per acre, and raising the seedlings carefully from seed, taking care to have them, when about 3 inches high, picked out about one foot apart, in order that they may develope well and become robust; this practice I fully believe saves at least one year's extra watering, and lessens the time during which a return must be waited for very considerably. The use of manure also economises watering, for not only does the manure by forcing the growth of the plants enable them to shade the ground earlier, but it also acts by retaining moisture.

119. The initial cost per acre of casuarina plantations on this system may be taken at Rupees 85; if to this capital we add interest at 10 per cent. for 4 years, a gross capital of Rupees 119 per acre may be taken to have been sunk in it at the end of that time. At this time half the trees (600) should be removed; valuing these at 8 Annas each, a price probably below their value, the capital will be returned and a balance of Rupees 181 left per acre; two years later another 200 trees worth Rupee 1 each could be removed, and in the eighth or ninth year the land could be cleared of the remaining 400 trees, which would yield at a low estimate Rupees 600 after paying all expenses on the same. It is surprising that with such a prospect more capital has not been invested in this industry around Madras. The mistake, which has led to so much doubtful success amongst casuarina planters, has been in taking up poor land, because of the inducements of the remission of rent for 10 years, and the non-use of manure; had fair land close to Madras been taken up, and the plants from their earliest stages liberally treated, far more success would have attended this industry.

Large profits obtainable.

Impolicy of common practice.

120. It is however quite possible to reduce the cost of planting by a great deal, for it will be observed that more than 29 per cent. of the cost is expended on pitting and planting; if, however, ploughs were used for making trenches in which to lay the seedlings, and the young plants used were small and not lifted from the nursery with a large ball of earth around their roots, the expense under these heads might be reduced to about Rupees 5 per acre, but in that case it would be advisable to plant the trees at least twice as thickly, thereby increasing the item for the cost of plants, if the same sized ones were used; but, as this however would not be necessary, in reality the cost of the plants would probably be about the same and the gross cost would be reduced to Rupees 65 per acre.

Use of plough in planting suggested.

121. *Permanent Improvements.*—A room was added to the Farm Superintendent's quarters at a cost of Rupees 1,200; the bungalow has cost altogether Rupees 5,631-10-7, which amount at $7\frac{1}{4}$ per cent. interest would represent a monthly charge of Rupees 34-5-5; the house would let in this neighbourhood at the rate of Rupees 45 per mensem, so that it has been erected at a cost well within its value; at $7\frac{1}{4}$ per cent. interest the whole capital will be repaid in 25 years as well as paying a regular interest of 5 per cent. on the investment.

Economical erection of Superintendent's bungalow.

122. The other improvements, carried out under the superintendence of Mr. Schiffmayer, comprise amongst others, the erection of a boiling and food preparing room, and a new cart shed; the levelling of nearly all the remaining fields of the farm which had before been untouched; the extension of the second irrigation channel referred to last year; the completion of the new main drive, with cross roads and bridges where necessary; working the tile-yard and brick-kiln; manuring heavily with black clay some of the land formed by the sand thrown up from the new irrigation channel; and the extension of our plantations over our poorer soils, as well as sundry other minor works.

123. It is hoped that this year will nearly see the conclusion of the alterations which want of method in commencing and a change in the object and uses of the farm have necessitated. So many alterations have seriously militated against the usefulness of the farm, but there cannot be any doubt that they have so improved the value of the estate as to leave no comparison possible between, what it was, and what it is.

Alterations prevent genuine work.

124. The numerous alterations and buildings going on have necessitated the employment of many of our cattle in carting and thereby sometimes delayed farm work, besides causing a heavy strain on the animals themselves, preventing the whole of them from being allowed a total rest occasionally, as would be very desirable.

(Signed) CHARLES BENSON, M.R.A.C.,
Superintendent of Sydapet Farm.

SYDAPET,
20*th July* 1878.

THE SCHOOL OF AGRICULTURE.

1. THE circumstances, which led to the establishment of this institution, and under which it was opened in the latter part of 1876, were noticed at some length in the last Annual Report.

2. A report on the First Session of the College has already been presented ; I have now to submit reports on the work of the Summer Session of 1877, and on that of the Winter Session of 1877 and 1878.

SUMMER SESSION OF 1877.

3. The Session began on the 1st of April, and ended on the 30th of June.

4. At the commencement of the Session, the names of 30 Agricultural Students and 20 Normal School Students were on the roll.

5. The following extracts from the reports of the Lecturers and Masters afford information regarding the work of the Session and the general conduct of the students :—

W. R. ROBERTSON, M.R.A.C., (AGRICULTURE).

" The class consisted of 50 students.

The lectures were on soils and manures, in continuation of the course begun in the preceding session.

It was found necessary to hold separate Field classes for the Agricultural Students and those of the Normal School, as the class when formed of all the students attending for instruction in agriculture was much too large for proper management out-of-doors.

The progress made by the class generally was satisfactory. I have never had occasion to find fault with the conduct of any member of the class."

GEORGE WESTERN, M.R.C.V.S., (VETERINARY).

"Lectures on Anatomy and Physiology were continued throughout the summer session; occasional examinations were also held. Lectures were as far as practicable illustrated by dissections and diagrams. The attendance of the students was regular, their conduct good, and progress on the whole satisfactory."

W. HAMILTON, (CHEMISTRY).

" The lectures were all illustrated by experiments.

The examination for twenty minutes on the occasion of each lecture was continued during the whole Session; and further experience enables me to state that the practice has been of much benefit to the students.

The conduct and industry of the whole class have been good ; many of the students have shown great interest in the subject, and a few have acquired a good knowledge of it."

R. WILKINS, F.R.C.S., (BOTANY).

"During the Session I lectured to the class on those portions of Morphology relating to flowers, fruit, and seed; on Histology, and on the Physiology of the root, stem, and leaves.

The conduct of the students was good; the interest taken in the subject by the majority of them very great, and their progress satisfactory. "

JAMES KEESS, M.D., &c., (ZOOLOGY).

"The course of Zoology was continued during the Summer Session. The whole of the sub-kingdom—Vertebrata—has been lectured upon. When lecturing on reptiles I laid great stress on the venomous snakes of India.

The students have all through evinced the greatest interest in the subject of Zoology.

The conduct of the students has been very satisfactory."

C. H. TAMBU PILLAY, F.A., (ARITHMETIC).

"The work of the class was not very satisfactory in some cases, owing to some members not being well grounded in the subject.

The conduct of the students was unexceptionable."

T. V. SEETHARAM MUDELLY, (MENSURATION AND SURVEYING).

"In Mensuration, the portion taught was that of surfaces.

In Surveying, the work done was with the chain only.

The conduct of the students was good."

6. The subjoined table shows the several courses of lectures, and the number of times each class met during the Session.

Subjects of each Course.	Number of Lectures and Formal Examinations.	Number of Field Classes.
Agriculture	19	13
Veterinary	22	..
Botany	24	11
Chemistry	19	..
Zoology	13	..
Arithmetic	22	..
Mensuration	23	..
Surveying	..	20

7. The following statement gives a summary of the results of the examinations held during the Session, with the marks obtained for attendance:—

Statement showing the Marks obtained by the Students during the Summer Session ending the 30th of June 1877.

Rank Number.	Name and Register Number.	Weekly Examinations.										Sessional Examinations.					Marks obtained.			
		Agriculture, 12th May.	Veterinary, 23rd May.	Chemistry, 26th May.	Mensuration, 28th May.	Botany, 2nd June.	Arithmetic, 5th June.	Zoology, 9th June.	Ploughing Examination, First Standard.	Arithmetic, 18th June.	Mensuration, 23rd June.	Agriculture, 25th June.	Veterinary, 26th June.	Chemistry, 27th June.	Botany, 28th June.	Zoology, 29th June.	Examinations.	Attendance.	Grand Total.	Per Cent. of total obtainable.
1	5. N. H. Patuck	93	71	88	68	81	91	85	40	90	95	191	174	188	173	120	1,648	137	1,785	83
2	26. C. K. Subba Row	90	90	81	75	89	96	75	35	90	76	184	143	179	170	110	1,583	141	1,724	80
3	10. G. Krishna Prabhu	94	95	79	...*	...	91	90	45	99	98	177	138	170	185	160	1,521	86	1,607	75
4	11. M. Narayana Row	92	82	72	61	75	70	65	45	91	70	150	139	144	162	105	1,423	117	1,540	72
5	28. A. D. Colah	80	75	44	65	92	12	75	85	30	78	165	115	142	180	140	1,378	147	1,525	71
6	2. P. D. Moody	90	72	78	71	79	41	75	50	42	95	166	116	138	171	90	1,374	138	1,512	70
7	25. K. M. Nagojee Row	91	68	62	60	54	86	50	50	63	85	174	160	141	130	60	1,334	149	1,483	69
8	14. V. S. Gurunatha Pillay	88	53	35	73	70	89	50	65	94	98	183	63	86	142	140	1,329	145	1,474	69
9	12. M. Hanumuntha Row	88	65	49	63	49	67	50	55	54	82	179	142	108	165	115	1,331	130	1,461	68
10	27. E. B. Krishna Row	82	66	45	55	55	95	45	35	93	78	171	130	62	133	120	1,265	147	1,412	66
11	4. J. M. Chichgar	89	74	54	40	70	25	70	40	30	64	158	132	131	155	95	1,227	122	1,349	63
12	15. N. M. Rego	85	38	44	52	89	77	50	55	39	80	155	109	109	125	85	1,142	118	1,260	59
13	7. C. Annamalay Moodelly	84	50	35	65	68	30	90	40	28	56	131	107	63	107	160	1,114	133	1,247	58
14	8. F. N. Kambatta	75	47	30	27	40	72	50	70	67	68	132	99	95	130	70	1,072	129	1,201	56
15	17. B. Ramiah Reddy	82	...	51	37	61	75	50	50	50	66	131	119	106	148	60	1,086	110	1,196	56
16	24. P. Vadantacharry	70	48	33	38	60	70	50	40	83	79	135	97	66	125	65	1,059	110	1,169	54
17	3. T. Varathiah	72	48	20	50	49	45	45	55	39	53	147	80	53	138	80	974	142	1,116	52
18	29. B. M. Dadiana	77	58	52	15	61	14	50	55	33	20	131	93	94	117	80	950	139	1,089	51
19	1. T. Balasundracharry	67	26	22	40	63	52	45	35	33	61	135	27	53	100	90	849	112	961	45
20	19. M. Damodara Moodelly	65	14	32	32	48	23	45	65	36	60	129	28	52	122	80	831	127	958	45
21	23. C. S. Streenivasa Row	66	52	21	27	12	20	65	55	41	45	108	91	45	70	60	778	139	917	43
22	20. R. Thamodara Naidu	72	41	35	37	...	...	40	50	18	59	105	77	66	109	80	789	116	905	42
23	18. C. Cuppusawmy Aucharry	63	6	23	32	35	37	30	50	68	66	115	16	34	93	100	768	134	902	42
24	22. M. N. Swernalinga Naicker	55	17	15	42	28	18	35	45	34	58	126	40	39	107	100	759	113	872	41
25	21. P. Jagannada Moodelly	75	50	32	36	31	...	40	40	7	32	141	58	33	90	85	750	109	859	40
26	9. A. Mooroogasa Pillay	25	21	12	21	45	17	60	35	22	47	79	38	54	100	55	631	129	760	35
27	30. B. H. Kotwal	70	57	53	15	52	19	85	60	36	61	143	...*	...	...	...	651	103	754	35
28	6. J. F. Lally	40	35	17	7	20	5	40	35	8	34	121	38	48	115	50	613	134	747	35
29	16. V. Streenivasa Iyer	85	62	45	63	64	75	45	40	69	...*	...	...	...	...	...	548	115	663	31
	Full Marks obtainable ...	100	100	100	100	100	100	100	100	100	100	200	200	200	200	200	2,000	150	2,150	100

* Sick.

Award of scholarships.

8. The general results were satisfactory. The three students who stood highest in the list obtained respectively 83, 80, and 75 per cent. of the full marks obtainable, and were awarded the three Government scholarships of Rupees 10 per mensem each, tenable for two years, which were offered for those students who gained the three first places in this Session. Eight students obtained 60 per cent. and upwards of full marks, and the average marks per head of the whole class were 55 per cent.

9. The prizes for the best notes of the lectures attended were awarded to—

Agriculture	1*st Prize*,	N. H. Patuck.
	2*nd* „	P. D Moody.
	3*rd* „	A. D. Colah.
Veterinary	1*st* „	A. D. Colah.
Zoology	1*st* „	B. H. Kotwal.
	2*nd* „	A. D. Colah.
	3*rd* „	V. S. Gurunatha Pillay.
Botany	1*st* „	A. D. Colah.
	2*nd* „	V. S. Gurunatha Pillay.
	3*rd* „	C. Annamalay Moodelly.

First standard of ploughing.

10. *Ploughing examination.*—An examination in ploughing with European ploughs was held during the Session. The work prescribed in the examination (first standard) was that each student should enter the plough at the headland, and plough three furrows up and down the field against a previously-laid furrow-slice. The whole of the students competed. At the first examination 15 students obtained 50 per cent. and upwards of full marks, and were declared to have passed. Student A. D. Colah stood highest with 85 per cent., and Student Kambatta second with 70 per cent. of full marks. At a subsequent examination in the same Session all the remaining students, excepting four, obtained the requisite number of marks, and were declared to have passed in this standard. Some of the ploughing done was very creditable, seeing that, owing to the drought, the opportunities for practice had been so few.

11. At the commencement of the Session under report, in accordance with the regulations laid down, the 24 sanctioned stipendiary studentships were awarded to the following students :—

G. Krishna Prabhu.	T. Balasundracharry.
N. H. Patuck.	A. D. Colah.
C. K. Subba Row.	B. H. Kotwal.
V. S. Gurunatha Pillay.	F. N. Kambatta.
M. Narayana Row.	M. Damodara Moodelly.
P. D. Moody.	A. Mooroogasa Pillay.
B. Ramiah Reddy.	T. Varathiah.
C. Annamalay Moodelly.	B. M. Dadiana.
J. M. Chichgar.	R. Thamodara Naidu.
E. B. Krishna Row.	M. N. Swernalinga Naicker.
V. Streenivasa Iyer.	P. Jagannada Moodelly.
N. M. Rego.	J. F. Lally.

These studentships are of the monthly value of Rupees 12½, and are tenable for 2½ years under certain prescribed conditions.

Normal School Students.

12. Twenty students of the Government Normal School attended the agricultural lectures from the commencement of the Session until the end of May, when they dispersed for their summer vacation. They formed part of a new class in the Normal School and had not attended any of the previous agricultural lectures. They made but little progress from not having attended the earlier part of the course and from having no elementary knowledge of the subject of the lectures. These youths attended nine lectures and only one examination. The results of that examination were as follows :—

Name.	Full Marks, 100. Marks awarded.
S. Narayana Iyer	73
A. Sami Iyer	57
K. Ragavendra Row	49
N. Parthasarady Iyengar	41
C. Patchayappen	41
A. Manikkam	40
P. Soobramaniya Iyer	39
C. Krishnasawmy Chetty	38
P. Seetharam Sastry	37
M. Ragavooloo Naidu	30
C. Tirumala Naidu	29
K. Streenivasa Iyengar	27
C. M. Streenivasacharry	21
P. A. Krishnamacharry	21
A. Sama Iyengar	21
D. Kachapeswara Iyer	19
V. Marga Sastry	18

WINTER SESSION OF 1877 AND 1878.

13. The Session began on the 1st of September and ended on the 31st of March. During the month of September there were no lectures or in-door classes, the work of the Farm having been allowed in that month to occupy the exclusive attention of the students. The lectures and class-room instruction commenced at the beginning of October.

14. In this Session the names of 52 students were on the roll of the College, of these 23 were those of students of the Madras Normal School who attended for instruction in Agriculture only.

15. The Lecturers and Masters reported on the work of the Session and on the general conduct and progress of the students as follows:—

W. R. ROBERTSON, M.R.A.C., (AGRICULTURE).

"The class was formed of 52 members: 29 Agricultural Students and 23 Normal School Students.

The lectures referred to Farm crops.

The attendance of the Agricultural Students was very regular. Very good progress was made by almost every member of the class, and the conduct of all was very creditable.

The Field classes are still much too large, and arrangements will have to be made for diminishing the numbers in a class, and holding more classes.

The arrangements under which the students from the Normal School attend for instruction in Agriculture continue to be unsatisfactory, and the progress of these youths is not therefore what could be desired."

G. WESTERN, M.R.C.V.S., (VETERINARY).

"The course begun last Session on the anatomy and physiology of the nervous system and of the special organs of sense was completed. And the proportion, actions, uses, modes of preparation, doses, &c. of the more important drugs employed in veterinary medicine was considered in detail. Particular attention was given to those procurable in the bazaars of this country.

The attendance of the students was regular, and their conduct in every respect satisfactory. The result of the Sessional examination is, I think, satisfactory evidence of their industry and application to this part of their studies. Experience seems to confirm the opinion already expressed that where there has been failure it is to be mainly attributed to a want of rudimentary education, and in particular to an imperfect knowledge of English."

W. HAMILTON, (CHEMISTRY).

"The course embraced the unfinished portion of inorganic chemistry, including a part of the non-metallic and the whole of the metallic substances mentioned in the syllabus, together with the general chemistry of organic bodies.

The lectures were illustrated by experiments, and the use of the necessary apparatus was explained.

The progress of the class was satisfactory, the students on the whole showing much interest in the subject and being very industrious.

The conduct of the whole class was unexceptionable."

R. WILKINS, F.R.C.S., (BOTANY).

"The lectures delivered treated of the following subjects: Chemical constituents of plants; Physiology of the floral envelopes; Functions of the reproductive organs; Physiology of the fruit and seed; Plant diseases; and systematic botany.

The papers submitted by the class were on the whole good, some exceptionally so.

The conduct of the youths was good, and the whole class merit approval for industry."

C. H. TAMBU PILLAY, F.A., (ARITHMETIC AND BOOK-KEEPING).

"Considerable improvement in arithmetic on the work done in the previous Session was noticed.

Book-keeping was commenced in February, and the class in general evinced great interest in acquiring a knowledge of the subject.

The behaviour and diligence of the class was in general very good."

T. V. SEETHARAM MUDELLY, (MENSURATION, SURVEYING, AND BUILDING).

"The subjects taught were the mensuration of solids, and the description of materials used in building.

In surveying the work done was surveying with the prismatic compass and chain.

The conduct and industry of the students were satisfactory."

16. The next table shows the various courses of lectures delivered, and the number of times each class met.

Subjects of Courses.	Number of Lectures and Formal Examinations.	Number of Field Classes.
Agriculture	42	33
Veterinary	48	..
Botany	49	15
Chemistry	49	..
Arithmetic and Book-keeping	62	..
Mensuration and Building	63	..
Surveying	..	20

17. The following statement shows the number of marks obtained by each of the students (Normal School Students excepted) at the examinations, and for attendance during the Session;—

Statement showing the Marks obtained by the Students during the Winter Session ending the 31st of March 1878.

Rank Number.	Name and Register Number.	Weekly Examinations.																		Sessional Examinations.				Cultivation Book.	Attendance.	Grand Total Marks obtained.	Per cent. of total obtainable.
		Agriculture, 10th November.	Veterinary, 17th November.	Botany, 1st December.	Agriculture, 15th December.	Chemistry, 17th December.	Veterinary, 12th January.	Mensuration, 16th January.	Chemistry, 19th January.	Arithmetic, 23rd January.	Botany, 31st January.	Mensuration, 5th February.	Agriculture, 9th February.	Arithmetic, 13th February.	Veterinary, 16th February.	Chemistry, 28rd February.	Botany, 2nd March.	Mensuration, 9th March.	Arithmetic, 16th March.	Agriculture, 25th March.	Veterinary, 26th March.	Chemistry, 27th March.	Botany, 28th March.				
1	5. N. H. Patuck	92	77	86	92	90	85	100	92	97	90	93	78	94	71	94	91	100	80	254	175	180	187	80	330	2,808	90
2	26. C. K. Subba Row	93	84	92	91	93	81	100	95	94	93	100	79	75	82	92	72	86	72	251	192	187	184	80	312	2,780	89
3	10. G. Krishna Prabhu	91	81	86	94	88	62	96	82	91	96	100	81	85	89	90	94	100	78	221	165	182	187	80	294	2,713	87
4	11. M. Narayana Row	86	84	80	87	85	75	91	87	70	92	100	78	96	74	91	88	100	92	220	173	165	186	80	318	2,698	86
5	2. P. D. Moody	88	55	92	78	77	85	100	90	81	76	94	87	82	73	88	81	100	58	204	165	159	150	80	336	2,579	82
6	31. R. D. Tata	91	48	74	86	71	59	92	80	95	82	93	68	79	60	85	58	100	78	224	166	144	134	70	336	2,473	79
7	25. K. M. Nagojee Row	90	72	80	77	66	78	94	70	94	72	88	65	89	80	80	58	76	66	232	169	137	133	70	299	2,435	78
8	7. C. Annamalay Moodelly	87	56	67	85	70	66	100	78	82	82	98	80	58	70	89	62	88	64	233	137	125	108	70	301	2,356	75
9	14. V. S. Gurunatha Pillay	79	61	72	84	45	63	96	61	97	78	91	74	86	44	63	65	100	84	246	116	118	93	80	319	2,315	74
10	27. E. B. Krishna Row	86	47	70	78	56	69	84	53	94	52	92	69	88	70	61	50	89	74	191	140	137	123	80	292	2,245	72
11	15. N. M. Rego	85	70	63	86	80	63	62	75	64	68	64	79	55	58	74	66	98	64	235	111	110	107	80	307	2,224	71
12	16. V. Streenivasa Iyer	73	64	66	77	82	53	97	70	51	66	77	55	62	84	91	60	66	76	176	131	163	114	60	282	2,196	70
13	4. J. M. Chichgar	75	77	74	69	67	73	80	73	50	72	88	69	67	73	65	56	62	76	179	129	118	104	60	323	2,179	69
14	8. F. N. Kambatta	62	39	59	75	63	49	75	72	71	60	81	74	61	59	64	77	88	52	224	106	142	108	70	335	2,166	69
15	28. A. D. Colah	72	52	76	71	54	60	28	58	39	76	55	81	39	49	71	76	55	38	214	110	113	150	70	325	2,032	65
16	30. B. H. Kotwal	58	66	60	80	62	64	36	63	49	84	55	62	40	46	69	63	86	52	207	124	83	108	60	320	1,997	64
17	17. B. Ramiah Reddy	77	57	58	75	43	60	98	43	83	64	75	72	61	42	60	53	98	86	183	102	135	83	60	227	1,995	64
18	29. B. M. Dadiana	78	36	72	65	46	51	62	62	60	70	69	75	40	44	57	52	66	58	200	120	117	108	60	315	1,983	63
19	20. R. Thamodara Naidu	55	43	69	77	52	58	74	69	45	74	78	52	39	53	52	52	89	33	144	92	118	135	50	318	1,921	61
20	9. A. Mooroogasa Pillay	67	26	60	70	55	36	64	55	56	74	82	58	53	50	59	60	68	58	168	103	91	102	60	309	1,884	60
21	3. T. Varathiah	64	39	37	63	...	59	60	60	55	70	85	76	47	63	47	66	82	52	158	130	95	97	70	304	1,879	60
22	19. M. Damodara Moodelly	53	27	27	69	49	29	51	59	65	72	60	66	56	36	67	63	69	46	140	84	82	111	60	222	1,673	53
23	1. T. Balasundracharry	73	41	54	61	32	18	40	...	79	84	61	66	58	38	43	65	62	72	184	83	76	83	60	194	1,626	51
24	21. P. Jagannada Moodelly	54	22	45	73	44	49	35	33	31	66	49	44	48	31	48	61	41	49	166	70	66	110	70	252	1,557	50
25	6. J. F. Lally	30	54	35	51	37	34	18	34	15	48	40	47	38	36	31	45	50	36	138	96	75	87	50	335	1,460	47
26	22. M. N. Swemalinga Naicker	28	16	41	58	43	9	32	36	17	44	57	59	24	36	42	50	61	40	152	69	58	88	50	303	1,413	45
27	23. C. S. Streenivasa Row	48	37	46	46	47	...	...	...	...	...	...	...	39	31	23	23	48	15	132	86	35	50	50	270	1,026	33
	Full Marks obtainable ...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	300	200	200	200	100	336	3,136	100

18. Copies of the question papers appear at the end of this report. On comparing the questions with the marks obtained by each student, it will be ascertained that the work done was very satisfactory. The three students to whom in the previous Session scholarships had been awarded maintained their position at the head of the list; they gained respectively 90, 89, and 87 per cent. of the whole marks obtainable throughout the entire Session. The whole class averaged per student 67 per cent. of the sum total of marks.

19. Prizes were offered for the three best-mounted collections of dried Native grasses; they were awarded as below:—

1st Prize.—Collection made by Student Patuck.
2nd do. — Do. do. do. Swernalinga Naicker.
3rd do. — Do. do. do. Kotwal.

The gentleman to whom the collections were sent for adjudication, wrote as follows:—

"All the specimens are neatly mounted, and some are fairly labelled.

20. The following are the names of the students who hold the three Government scholarships:—

Nowrojee Hormusjee Patuck.
C. K. Subba Row.
G. Krishna Prabhu.

In the table below the marks which they have obtained since they joined the College are given:—

Sessions.	Full Marks obtainable.	Marks obtained.		
		N. H. Patuck.	C. K. Subba Row.	G. Krishna Prabhu.
Winter Session, 1876-77	2,522	2,111	2,058	2,209
Summer ,, 1877	2,150	1,785	1,724	1,607
Winter ,, 1877-78	3,136	2,808	2,780	2,713
Total ..	7,808	6,704	6,562	6,529
Percentage of full marks	100	86	84	84

Cultivation books kept satisfactorily.

21. During this Session, each student was required to keep a "Farm Cultivation Book." In these books the history of each crop was to be recorded, together with its financial results. From other employments demanding their attention, except during certain part of each day, the students could not produce an exact debit and credit account of each crop: the majority of their books have, however, been kept in a very satisfactory manner, very full details being recorded of matters of interest regarding the crops as well as the approximate cost, and the returns in each case. In collecting the data required in keeping these books much practical information must have been gathered. At the Field classes the cost of, and return from, different crops, frequently formed the subject of interesting discussions, in which the facts collected by the students in keeping their cultivation books were often brought into prominence.

Increase of stipends.

22. The stipends of the under-mentioned students were increased by Rupees 2½ per mensem from the 1st of October, to which increment at the beginning of the second year, and to a similar one at the beginning of the third year, they are entitled on fulfilling the conditions of the following rule:—"Those students, who receive half of the total marks obtainable, and one-third of the total marks allotted for each subject during each Session, shall be qualified for promotion to a higher grade." The students who fulfilled these conditions were:—

N. H. Patuck.
G. Krishna Prabhu.
C. K. Subba Row.
E. B. Krishna Row.
C. Annamalay Moodelly.
B. Ramiah Reddy.

V. S. Gurunatha Pillay.	N. M. Rego.
M. Narayana Row.	F. N. Kambatta.
P. D. Moody.	V. Streenivasa Iyer.

23. One of the youths holding the Holkar Stipendiaryships, I regret to state, died when at his home during the Christmas vacation. The deceased was a youth of much promise. The vacancy then caused will be refilled when another class is formed.

24. From the advanced stage of the present course, and the largeness of the class, no fresh admissions were made except in the case of three youths sent to the College by an association established, in the Collectorate of Kaira in the Bombay Presidency, for the promotion of agriculture. This association is composed of Native cultivators, and the three youths are supported at the College by funds provided by it. These youths have been permitted to study with the present class; they will however join the next class when it is formed.

25. At the commencement of the Session, the Government Normal School sent 23 students to attend the agricultural lectures. Most of these had attended the agricultural lectures during a part of the previous Summer Session; but none of them attended lectures during the whole of the Winter course; the majority ceasing attendance in February, at about which time their course of training in the Normal School came to an end. They attended in all 25 lectures and 2 examinations; the subjoined statement shows the marks they obtained at these examinations.

Name.	Examination held on the 10th November 1877.	Examination held on the 15th December 1877.
	Full Marks, 100.	Full Marks, 100.
	Marks awarded.	Marks awarded.
S. Nagaswara Iyer	70	80
P. Gopala Menon	70	68
C. Terumalai Naidu	59	37
P. Soobramania Iyer	57	42
A. Manicka Moodelly	54	59
C. Pachayappa Moodelly	52	50
N. Kunya Kudta Panikar	50	46
V. Marga Sastry	48	..
A. N. Sricundiah	44	65
A. Sama Iyer	42	64
C. Viraragavacharry	40	66
C. Krishnama Chetty	38	31
D. Kachapaswara Iyer	36	8
A. Sama Iyengar	33	44
P. Sitarama Sastry	30	31
C. M. Streenivasa Charry	29	26
P. Ragavulu Naidu	29	..
K. Streenivasa Iyengar	28	30
K. V. Abharam	..	56
P. A. Krishnama Charry	..	25

Of the new class formed in the Normal School in February, about 20 of the students attended the agricultural lectures up to the end of the Session. They attended 13 lectures and 1 examination; the next table shows the result of that examination.

Name.	Full Marks, 200.
	Marks awarded.
V. Soobramaniam	96
T. A. Ramachundra Iyer	90
G. Vencatasubba Iyer	89
V. Ragoonatha Iyer	63
W. Nathamunisawmy Pillay	46
M. Soobramania Iyer	41
S. Ponnambalam	35
S. Bashyam Iyengar	25
K. Srikanaka Sastry	18
K. Thomas	13
C. Streenivasa Iyer	5
S. Vencatasoobier	5

These results are even less satisfactory than those obtained by Normal School Students at previous examinations, notwithstanding that the examination questions were confined only to subjects treated in the lectures which these students had attended, these being only a few at the end of the course.

Correspondence regarding the improvement of arrangements for teaching Normal Students.

26. The arrangements, under which the Normal School Students attend for instruction in agriculture, are very unsatisfactory, and they formed the subject of some correspondence between certain officers of the Educational Department and myself. It seems desirable that extracts from this correspondence should appear here in order to remove some misconceptions which seem to have been formed in certain quarters. The correspondence began by the Director of Public Instruction forwarding to the Inspector of Schools, Presidency Division, an extract (paragraph 28) from my last report, and inviting him, in communication with the Principal of the Normal School and myself, to consider whether some more suitable arrangements than those in force could not be suggested. Colonel Macdonald stated—

"Probably the most convenient plan would be to make the Normal School Session commence on the 1st of April to time the vacation so that it shall not clash with the work of the School of Agriculture, and to arrange so as to give the Normal School Students as much agricultural instruction as possible between the 1st of January and the 31st of March during which period there is comparatively little work for them in the Normal School."

The Principal of the Normal School in reply, in addressing the Inspector of Schools, wrote—

"I as well as Mr. Robertson find the present arrangements for giving the Normal Students instruction in agricultural very unsatisfactory.

Twice a week, as a rule, all the students, except the few graduates have to leave the school in the early part of the afternoon, breaking in upon the regular work of both the students and of the Practising School."

He considered it to be impracticable to alter the Session of the Normal School, and stated—

"Taking everything into consideration it seems to me that the best plan for imparting knowledge of the principles of agriculture to the students would be for the Professor to give a course of lectures at the Normal School."

In forwarding these proposals for my opinion, the Inspector of Schools remarked—

"I myself can see no more convenient way of giving Normal Students a regular course of theoretical agriculture than that which Mr. Morgan suggests. For the practical part it might be possible to arrange for the occasional visit of the students to the Farm."

In my reply I wrote :—

"I agree generally with Mr. Morgan in thinking that the arrangements suggested by him would be attended with much fewer inconveniences than those now in operation, but I fear the course suggested is impracticable, for I would not undertake to deliver a course of lectures at the Normal School, nor at present could either of my assistants. However, were it possible to arrange for the delivery of a course of lectures at the Normal School, the benefit arising therefrom to the students would not, in my opinion, be nearly so great, as would arise from their attending at the Farm for instruction.

Under any circumstances they can be afforded only a theoretical knowledge of agriculture, but this should include a *personal knowledge* of *the objects* and *conditions* with which agriculture has to do, which knowledge cannot be gained in the Lecture Room. A *practical knowledge* of agriculture, I of course do not expect on the part of these students, this could be gained only after years of careful and close observation in carrying on agricultural operations."

Special course of lectures must be arranged.

27. It is quite clear that a special short course of lectures must be arranged for the students of the Normal School. It is of great importance that these embryo Schoolmasters should be afforded some instruction in the principles of agriculture, even though their opportunities for gaining much information by such means are small. A course to begin in October and end in March, when the annual class of Normal School is usually broken up, might be attempted with some prospect of good resulting. At present there are difficulties in the way of the delivery of such a course of lectures; however efforts should be made to overcome these difficulties.

GENERAL REMARKS.

Fair general education necessary for appreciation of lectures.

28. It has been suggested that fewer admissions should be granted under the rule by which those who have passed the Matriculation and other examinations are admitted. Experience is however opposed to this suggestion, for I find that the youths so admitted have made a much better use of their opportunities than those admitted under the lower standard prescribed for the entrance examination. The only complaint the lecturers ever make of the students is that a few of them (those admitted under the entrance examination rules) are not sufficiently well educated to be able to follow the lectures.

29. The three tables that follow show the marks obtained by students who were admitted under the entrance examination rules, or from their being eligible for admission by having passed certain prescribed examinations.

Students admitted, who were Undergraduates of the Madras and Bombay Universities.

Name and Register Number.	Winter Session, 1876-77.	Summer Session, 1877.	Winter Session, 1877-78.	Total.	Remarks.
Full Marks ...	2,522	2,150	3,136	7,808	
5. N. H. Patuck	2,111	1,785	2,808	6,704	F.A. of the Bombay University.
26. C. K. Subba Row	2,058	1,724	2,780	6,562	F.A. of the Madras University.
10. G. Krishna Prabhu	2,209	1,607	2,713	6,529	Admitted under the entrance examination but he shortly afterwards passed the Matriculation examination.
11. M. Narayana Row	1,812	1,540	2,698	6,050	
2. P. D. Moody	1,752	1,512	2,579	5,843	
14. V. S. Gurunatha Pillay	1,890	1,474	2,315	5,679	
25. K. M. Nagojee Row	1,683	1,483	2,435	5,601	
27. E. B. Krishna Row	1,578	1,412	2,245	5,235	
29. B. M. Dadiana	1,177	1,089	1,983	4,249	
31. R. D. Tata	...	...	2,473	2,473	Joined only at the beginning of the Winter Session of 1877-78.
12. M. Hanumuntha Row	...	1,461	242 *	1,703	Died at his home when on leave at 'Xmas.
24. Vadantacharry	...	1,169	...	1,169	Left.

Average marks obtained 5,828 or 75 per cent.

Students admitted who had passed the U.C S. General Test Examination, or an equivalent examination in another Presidency.

Full Marks ...	2,522	2,150	3,136	7,808	
7. C. Annamalay Moodelly	1,695	1,217	2,356	5,298	
4. J. M. Chichgar	1,694	1,349	2,179	5,222	
28. A. D. Colah	1,507	1,525	2,032	5,064	
8. F. N. Kambatta	1,387	1,201	2,166	4,754	
30. B. H. Kotwal	1,492	754 †	1,997	4,243	Average marks obtained 4,434 or 57 per cent.
3. T. Varathiah	1,247	1,116	1,879	4,242	
1. T. Balasundracharry	1,513	961	1,626	4,100	
9. A. Mooroogasa Pillay	1,295	760	1,884	3,939	
6. J. F. Lally	841	747	1,460	3,048	

Students admitted on passing the Entrance Examination of the Institution.

Full Marks ...	2,522	2,150	3,136	7,808	
15. N. M. Rego	1,525	1,260	2,224	5,009	
17. B. Ramiah Reddy	1,715	1,196	1,995	4,906	
16. V. Streenivasa Iyer	1,536	663 †	2,196	4,395	
19. M. Damodara Moodelly	1,371	958	1,673	4,002	Average marks obtained 3,967 or 51 per cent.
20. R. Thamodara Naidu	1,133	905	1,921	3,959	
21. P. Jagannada Moodelly	1,039	859	1,557	3,455	
22. M. N. Swernalinga Naicker ...	1,047	872	1,413	3,332	
23. C. S. Streenivasa Row	738	917	1,026	2,681	
18. C. Cuppusawmy Auchary ...	509	902	...	1,411	Left.

* Attended only three of the examinations.
Absent from the Sessional examinations.

A glance at these tables will show how much superior were the results achieved by the more highly-educated students. The education given in the College is unavoidably costly; it is therefore decidedly the best policy to admit to its benefit only those who are really competent to benefit fully from the instruction given. The education of the general agricultural population can be undertaken afterwards, by employing in the work the men who have undergone a competent training in this College.

Superior results from well educated students.

30. A gymnastic class is being formed, and will begin work next Session; sanction having been given for the entertainment of an Instructor, and for providing the necessary apparatus. This has been done at the suggestion of the students, who all evince much interest in the physical education it is proposed to afford. It is to be hoped that in developing the bodies of our students there will be a corresponding development of their mental faculties.

Organisation of a gymnastic class.

31. Botanical grounds are being laid out on a portion of the Farm near the site selected for the educational buildings. Here small experiments will be made which require greater care than it is possible to give in the case of ordinary field experiments; and plants, shrubs, and fruit trees will be grown, with which it is desirable that the students should be acquainted, and which will afford illustrations for the Botanical Lecturer in teaching his class.

Formation and objects of botanical grounds.

32. The cottages for the occupation of the students, who desire to reside on the Farm, have all been completed. They are now occupied by 24 students, who pay rents varying from 1½ Rupees to 3 Rupees per mensem for each cottage. There are many advantages attending the residence of the students on the Farm, and every encouragement is held out to them to do so in preference to living in the neighbouring villages.

Quartees supplied on the Farm for 24 students.

33. The Library contains the following volumes: Agriculture and Horticulture and Aboriculture, 221; Botany and Vegetable Physiology 32; Veterinary, Zoology and Animal Physiology, 72; Chemistry and Mineralogy, 46; Geology and Engineering, 77; other works 69; total, 517; of these 129 are books of reference.

34. A good use was made of the Library by the students, the following works being taken out by them to read: Agriculture and Horticulture, 49; Chemistry, 70; Botany and Vegetable Physiology 11; Veterinary, Zoology and Animal Physiology, 59; other scientific works, 19. The works of reference, the removal of which from the Library premises is not allowed, were also largely used.

Value of Library appreciated.

35. The Reading Room was during the year only poorly supplied with agricultural newspapers and periodicals, owing to the non-arrival of those that had been indented for from England and America. It is hoped that under the new arrangements sanctioned these publications will in future be supplied with greater regularity.

36. A collection of geological specimens was presented to the Museum by George Western, Esq., to whom also we are indebted for a collection of specimens for illustrating the Materia Medica Lectures. A fine skeleton of a full grown Mysore ox was presented by the Superintendent of the Central Museum. Additions were made to the collections of pulses and grains, and fair average samples of these productions were forwarded to England for analysis, the results of which, when obtained, will be of much use in the lectures delivered in the College, and to the general public. Other additions of objects of interest have been made from time to time. Tabular statements showing the rainfall of the district, crop statistics of the Presidency, &c., &c., have been made and hung on the walls of the room; others will be prepared as opportunity arises.

Additions to Museum collection.

37. The erection of the building for the chemical laboratory has been commenced; it is expected that it will be finished before September, and will be available for use in the next Winter

Erection of laboratory. *

* The building is completed.—C.B., 2-9-78.

Session. Arrangements are being made in England for supplying the apparatus and chemicals needed. The building is 60 feet long, 20 feet wide, and 18 feet in height, with wide verandahs all round; it will afford accommodation for a working class of about 30 members.

38. The College itself however is still housed in the highly inconvenient manner described at paragraph 15 of the last report. From this cause its work suffers in various ways. From the great heat in the Lecture Room during the day we have been forced to confine the lectures to the morning and evening which interferes to some extent with the out-of-door duties of the students; and from the very limited accommodation available, it has as yet been impossible to admit another class of students. The consequence of this will be a break of at the least two years between the first and second classes, assuming that arrangements will be made to render it possible to admit a new class in September, which now seems unlikely.*

Inconvenience, insufficiency and unsuitability of present accommodation.

39. I have repeatedly pointed out the urgent needs of the institution as regards accommodation; a large annual expenditure is now being incurred for salaries, stipends, &c.; from this expenditure the best results cannot possibly be secured under the present circumstances of the institution. As noticed in my last report the plans and estimates for suitable buildings were long ago sanctioned, and the funds needed are forthcoming. If this institution is required, and it is almost universally admitted that it is very urgently needed, the least that can be done for it is to provide it with such house accommodation as will admit of its work being conducted under satisfactory conditions.

Erection of buildings deferred although money available for the purpose.

40. The expenses incurred on behalf of the institution are shown in the next statement.

* Orders were received on September 1st to admit a second class without delay, but still no provision made for adequate accommodation.—C.B., Ag. Supt., Govt. Farms.

	[illegible]												ber.			November.			December.			January 1878.			February.			March.			Total.			Grand Total.		
													RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.			
Lecture F[illegible]																																			
Agricultural Lectu[illegible]													...			...			...			...			...			...			...					
Veterinary do.													0	0	220	0	0	...			...			...			...			1,480	0	0			
Chemical do.													0	0	240	0	0	...			...			180	0	0	160	0	0	140	0	0	180	0	0	180	0	0	1,420	0	0			
Botanical do.													0	0	240	0	0	...			...			180	0	0	160	0	0	140	0	0	160	0	0	180	0	0	1,420	0	0			
Zoological do.													0	0	240	0	0	...			...			180	0	0	160	0	0	180	0	0	160	0	0	180	0	0	1,500	0	0			
													0	0	100	0	0	140	0	0	...			100	0	0	80	0	0	80	0	0	40	0	0	...			640	0	0			
																																							5,040	0	0
Salaries and Wages.																																									
First Master	150	0	0	190	2	0	143	5	4	130	0	0	130	0	0	130	0	0	130	0	0	130	0	0	130	0	0	130	0	0	1,653	7	4			
Second [illegible]ter	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	1,200	0	0			
Clerk	25	0	0	25	0	0	25	0	0	25	0	0	30	0	0	30	0	0	30	0	0	30	0	0	30	0	0	30	0	0	340	0	0			
Draftsman	24	3	1	24	2	8	...			...			20	2	7	24	3	1	23	5	4	25	0	0	...			...			141	0	9			
Muchee, Peons, and other Servants.	35	8	0	35	8	0	35	8	0	35	8	0	32	13	5	35	0	3	35	8	0	35	8	0	35	8	0	34	0	0	34	0	0	419	13	8
																																						3,754	5	9
Stipends and Scholarships.																																								
Stipendiary Studentships ...		...		300	0	0	300	0	0	300	0	0	300	0	0	300	0	0	300	0	0	300	0	0	300	0	0	300	0	0	450	0	0	3,450	0	0
Scholarships		...		...			...			...			...			...			30	0	0	30	0	0	30	0	0	30	0	0	30	0	0	150	0	0
																																						3,600	0	0
Other Charges.																																									
Paid by transfer value of freight on Text Books, &c.		...		...			...			...			...			...			...			...			...			...			403	13	10			
Paid by transfer Presidency Medical Stores Department for chemicals supplied.		...		...			...			...			...			...			...			...			...			...			98	14	3			
																																						502	12	1
Special Charges.																																									
House accommodation ...	70	0	0	70	0	0	125	0	0	148	4	11	13	[illegible]		125	0	0	125	0	0	125	0	0	125	0	0	125	0	0	125	0	0	1,427	10	6			
Books for the Library ...	61	12	0	...			...			...			[illegible]			...			...			26	4	0	36	0	0	...			...			124	0	0			
Contingencies	89	15	9	132	14	6	90	13	4	21	1	0	[illegible]		3	43	2	6	15	3	9	329	5	5	109	11	0	68	13	7	41	11	7	56	10	8	1,026	3	4
Students' cottages and cook houses.		...			...			...			...			...			...			...			...			...			...			...			4,441	3	7
																																						7,019	1	5
																																		Total ...			19,916	3	3

41. Below are printed the question papers of the two Sessions under report, classified according to the subjects taught:—

AGRICULTURE.

Summer Session, 1877.

Weekly Examination—May 12th, 1877.

I. State what you know regarding the yield of wool from the sheep recently clipped.

II. What is meant by—(1) Hydrostatic Water—(2) Cappillary Water—and, (3) Hygroscopic Water?

III. What is Humas, and of what use is it in a soil?

IV. What becomes of the water taken up by plants through their roots?

V. What is Saltpetre, and what can it supply to plants when used as a manure?

VI. State what operations have been performed in field $\frac{A}{11}$, on behalf of the Cholum crop now growing there.

VII. What gases are found in fertile soils?

VIII. Explain the disappearance and reappearance of a salt efflorescence on some land.

IX. What is understood by (1) the Active, (2) the Dormant, and (3) the Passive, constituents of a soil?

X. What elements of plant food are the most costly and difficult to provide?

Sessional Examination—June 25th, 1877.

I. Explain in what way Agriculture suffers in this Presidency, from the general use of cattle dung as fuel.

II. State all you know about the Indigo crop growing in field $\frac{C}{15}$.

III. Write a short paper on lime as a manure.

IV. What is a special manure? and, what is a general manure? Mention examples.

V. When we say that an arable soil is exhausted, what do we mean?

VI. State what crop is growing in field $\frac{C}{18}$, and give details of cultivation.

VII. Value the manure of which the following is an average analysis:—

	Per Cent.
Water	15·40
Insoluble phosphates	31·60
Soluble phosphates	18·40
Alkaline salts	3·60
Sulphate of lime	25·80
Sand	5·20
	100·00
Ammonia	2·50

VIII. State generally the conditions on which the fertility of a soil depends.

IX. Mention some quickly acting nitrogenous manures.

X. State what you know about the management of the Farm sheep.

Winter Session, 1877-78.

Weekly Examination—November 10th, 1877.

I. Under what conditions are crops considered to be Restorative Crops?

II. State generally in what way crops benefit, from the land on which they are growing being irrigated.

III. What is the important difference between the general character of the cropping of England and of this Presidency?

IV. In what way does the occasional drying of paddy land prove advantageous to the crop?

V. What weight of paddy seed is required, for raising sufficient seedlings to plant an acre of land, and what weight to sow an acre of land broadcast?

VI. What conditions are necessary for the successful culture of paddy?

VII. Name the chief Food Corn crops raised in this Presidency.

VIII. How would you proceed to determine the vitality of a sample of seed?

IX. What is the average cost per acre on the Farm, for Ploughing, Hand-hoeing, and Harrowing?

X. Did the Maize seed, sown on the Farm during the present season, undergo any special preparation; if so, what?

Weekly Examination—December 15th, 1877.

I. What are the uses of the Plant and Grain of the Chinese Sorghum (Sorghum saccharatum)?

II. Describe and value the operations performed for the present crop, in Field No. 16.

III. What kind of Wheat is grown in this Presidency, and what are its general characteristics?

IV. What Manures are used in America for manuring Paddy land?

V. At what stage in growth should Chinese Sugar-cane plants be cut when the juice is required for making sugar?

VI. What is the average cost, per acre, on the Farm for (1) Cultivating, (2) Subsoil-ploughing, (3) Sowing Seed by the seed-drill?

VII. State generally what you know about the fodder-producing capabilities of Cholum (Sorghum vulgare).

VIII. What are the chief differences between the Wheats of hot climates, and those of temperate climates?

IX. What kind of soil is said to be the best suited for the growth of Sugar-producing Plants?

X. What weight of Sugar has been obtained from Sugar Sorghum Plants produced on one acre of land?

Weekly Examination—February 9th, 1878.

I. How many pounds of oil should 100 pounds of good Castor Beans yield?

II. What breeds of horned stock are kept on the Farm?

III. Give the scientific and common names of the principal food pulse crops of this Presidency.

IV. What are the average percentages of albuminoids, and of fat, found in the Horse-gram and Bengal-gram.

V. What crops are growing in the following fields:—No. 18, No. 14, No. 3, and No. 10-B?

VI. Estimate the expenses per pair, for the maintenance of the working cattle of the Farm.

VII. Describe how lamp-oil is usually extracted and prepared in this country.

VIII. What do you understand by under-drainage?

IX. What is (1) a heifer, (2) a wether, (3) a capon, (4) a gimmer?

X. What is the scientific name of raggy, and to what uses can the crop be devoted?

Sessional Examination—March 25th, 1878.

I. What would be the cost of applying to one acre of Field No. 11, by means of the double-mhote in use there, a quantity of water equal to 1 inch of rainfall? (value the apparatus, complete, at Rs. 120 and the bullock at Rs. 50).

II. Mention in what way the Ryot would benefit, by devoting a small proportion of his land, annually, to the production of a fodder crop for consumption by his stock.

III. Mention the common names of the more important of the fibrous plants of India; and state what you know about the Hibiscus subdariffa, the Hibiscus esculentus, and the Crotalaria juncea.

IV. State, generally, the reasons why in some cases paddy seed should be sown broadcast in the field; and, give the reasons, under which it would be preferable to sow the seed in seed-beds, and to transplant the seedlings into the field.

V. Describe the field culture of the flax crop, and the treatment the plant undergoes afterwards prior to scutching.

VI. Describe and value the operations performed in Field No. 18 for the present crop, and estimate the probable money return of the crop.

VII. What are the advantages of growing Maize and Cotton together, in alternate lines?

VIII. What varieties of cotton have been grown on the Farm; state generally what you know about the yield and quality of the lint of each.

IX. Explain why drain-pipes placed in the earth 4 feet deep will, after heavy rain, discharge water sooner than pipes placed only 3 feet deep.

X. Whether is Bengal-gram, or Horse-gram, the most fattening food, and which is best suited as food for hard-worked horses?

VETERINARY.

Summer Session, 1877.

Weekly Examination—May 19th, 1877.

I. What is the reason that confinement of animals in close unventilated sheds is injurious?

II. What is a gland?

III. How is the gastric juice produced, what is its use and what are its principal ingredients?

IV. What is the use of the Liver?

V. With what secretions does the food become mixed in the duodenum, and what is their effect upon it?

VI. How do the large intestines of the Horse differ in appearance from those of the Ox and Sheep?

VII. Name the different parts of the intestines.

VIII. Of what tissues is the coat of the intestines made up?

IX. How many teeth has a full grown Sheep in the lower jaw?

X. Where do the lacteals begin, where do they end, and what do they contain?

Sessional Examination—Tuesday, June 26th, 1877.

I. What organs are engaged in the removal, from the body, of the products of the metamorphosis of the tissues?

II. In what forms are these products chiefly removed?

III. What is the difference between the property of elasticity possessed by yellow elastic tissue and contractility of muscular fibre?

IV. Why is there no pulse in the veins?

V. What is the temperature of the Blood?

VI. How does the Lymph differ from the Blood?

VII. What is the most important difference between the venous and arterial blood?

VIII. What are the Ureters and what their function?

IX. How is the Urine expelled from the bladder?

X. What are the chief constituents of the Urine of Herbivora?

XI. What is the peculiarity of the blood of the Renal Veins?

XII. What relations have the bulk and length of a muscle to its function?

XIII. What is the Rigor Mortis and what is the cause thereof?

XIV. What descriptions of movement are permitted by pure hinge joints?

XV. Describe in a few words the alimentary apparatus of animals and its use.

Winter Session, 1877-78.

Weekly Examination—November 17th, 1877.

I. In what forms does a living animal lose substance by giving out heat, and the exertion of mechanical force; and how is the loss made good?

II. What is local death; and what is general death?

III. What is the immediate cause of death?

IV. What is the use of the Spinal Cord?

V. What is the structural difference between the grey and the white matters of the nervous system?

VI. How do the upper roots of the spinal nerves differ from the lower roots?

VII. What is the function of the eighth pair of nerves?

VIII. Which is the special nerve of smell, and in which of the domestic animals is it most developed?

IX. What is the organ of the sense of taste?

X. What percentage of its volume of oxygen does the air lose in passing through the lungs?

Weekly Examination—January 12th, 1878.

I. What are the advantages of the powder as a form for the administration of medicine to animals?

II. What is the meaning of the terms maceration, decoction, and infusion as applied to the preparation of medicines?

III. How does the drachm Avoirdupois weight, differ from the drachm Apothecaries weight, and how many of the latter are there in a tolah?

IV. How many fluid ounces go to a common quart beer bottle; and how many are there in an imperial quart?

V. What do you understand by the "topical" and "remote effects" of a medicine?

VI. What is the cause of the remote effects of a medicine?

VII. What are Cathartics, Cholagogues, Laxatives, Hydragogues and Drastics?

VIII. What are the medicinal effects of Aloes?

IX. On what part of the alimentary canal is the effect of Aloes most marked?

X. How does Croton differ from Aloes in its action on animals?

Weekly Examination—February 16th, 1878.

I. Which is the most commonly employed Purgative for the Ox and in what dose would you give it?

II. What is Epsom salt and how is it prepared?

III. How may Epsom salt be distinguished from Oxalic Acid or Sulphate of Zinc?

IV. What is Calomel and by what characters and tests may it be identified?

V. Why is the native Sulphur, procurable in the bazaar, objectionable for internal use?

VI. What is the best form for the external application of Sulphur?

VII. In what disease is Sulphur employed?

VIII. What are the actions and uses of Linseed Oil?

IX. What dose of Castor Oil would you give to cattle as a purgative, and with what agents would you combine it, to increase its purgative effect, or, to diminish its irritative effects?

X. What effect has the combination of a Vegetable bitter, or the Sulphate of Iron, on the purgative action of Aloes?

Sessional Examination—March 26th, 1878.

I. What are the medicinal uses of common Salt?

II. What are "Salt-cake" and "Soda-ash" and how are they made?

III. Describe the mode of preparation of Bicarbonate of Soda.

IV. What is Pearlash and how is it prepared?

V. What is Croton Oil, and what are its uses?

VI. From what Plant do we get Castor Oil, and how?

VII. What Salts of Magnesia are employed in medicine and for what?

VII. What is the composition of "Sheep and Calves' cordial" its use and doses to be given?

IX. By what characters and tests would you recognise Carbonate of Potash?

X. What therapeutic agents are obtained from the common Flax plant (Linum Usitatissimum)?

* *

CHEMISTRY.

Summer Session, 1877.

Weekly Examination—May 26th, 1877.

I. How is Nitrogen gas prepared? State its properties.

II. Give the composition of atmospheric air, and state reasons for considering it a mixture and not a chemical compound?

III. How do you prepare Ammonia gas? Mention experiments performed to illustrate its properties.

IV. Why are Ammoniacal salts classed with those of Potassium and Sodium?

V. How is Nitric Acid prepared?

VI. How would you detect the presence of Nitric Acid in a given solution?

VII. Trace the origin of Nitrates, and describe the process of manufacturing Nitre in India.

VIII. Define the following terms:—

Dyad; Univalent; Tribasic; Neutral; Acid; Alkaline.

Sessional Examination—June 27th, 1877.

I. What is the chief source of the Nitrogen found in plants?

II. Sulphur: Give its mode of extraction and its several allotropic forms and their characters.

III. Describe the preparation of H_2S and its properties, and state its uses in the laboratory.

IV. What are the ingredients and the quantities you would take to prepare 1 litre of SO_2 at standard temperature and pressure?

V. Describe the properties of Sulphurous Acid, and show how it differs from chlorine as a decolorizer.

VI. Name the substances essential for the production of Oil of Vitriol; mention briefly how these are generated; and show by symbols the successive changes which result by their admixture.

VII. Describe Carbon Dioxide, its preparation, composition, and properties; and state the important uses it subserves in Nature.

VIII. State the various sources of Phosphates. How is Phosphorus extracted?

IX. How many volumes of their respective elements are contained in two volumes of each of the following gases:—

SO_2; H_2S; HCl; Steam; and NH_3?

X. Give the formulæ representing the composition of the following: Carbonic Acid; Hydrochloric Acid; Nitric Acid; Phosphoric Acid; and Sulphurous Acid. Also, the formulæ of the neutral salts produced by combination of these acids with the metallic base Calcium.

Winter Session, 1877-78.

Weekly Examination—December 17th, 1877.

I. State what you saw when metallic potassium was thrown into a dish of water. Explain the nature of the changes in symbols. What two substances were formed?

II. Distinguish between *pearl ash* and *potash*. Give the preparations of both, and state the uses to which they are applied.

III. How would you detect Iodine in solution both in its free and combined state?

IV. An Epidemic has broken out amongst cattle in an enclosed shed, and the atmosphere therein has been ordered to be purified. What disinfectant would you employ, and how would you use it?

V. Mention the different varieties of Silicon and give a brief description of their characters?

VI. Why is Guano useful as a manure?

VII. Write the formulæ and systematic names of the mineral constituents of a sample of Coffee manure having the following composition:—

	Per Cent.
Water	8·76
Organic matter (containing Ammonia 4·24).	36·85
Biphosphate of lime, Manobasic phosphate of lime.	6·69
Tribasic phosphate of lime	18·68
Sulphate of lime .. .. .. } Do. of Magnesia .. .. }	7·50
Alkaline Salts*	20·57
Sand	3·32

* The metals referred to are to be stated.

Weekly Examination—January 19th, 1878.

I. Describe the Salt-cake process, and the decompositions by which Salt-cake is converted into Soda-ash.

II. Give the composition of Quick-lime and Slaked-lime. How is the former prepared? State the uses of Lime in Agriculture.

III. Define a Hard-water. How can a Hard-water be softened? How is the hardness of a water determined?

IV. How would you ascertain the presence of Lime in a given sample of soil?

V. What is White Arsenic, and how is it obtained?

VI. Describe Marsh's test for Arsenic and point out how it serves to distinguish that metal from Antimony.

VII. A Cow on the Farm is suspected to have been poisoned with Arsenic; the contents of the stomach are given to you; state the operations necessary for the discovery of the poison.

Weekly Examination—February 23rd, 1878.

I. How is Lead obtained from Galena? Under what circumstances is Lead found in spring water, and how would you discover its presence therein?

II. What is Black Oxide of Copper; how is it prepared; and what are its uses in analysis?

III. Give the tests for the Salts of Copper, and explain the several reactions by symbols.

IV. Describe the process of Cupellation?

V. Where is Platinum chiefly found and how is it extracted? State the uses to which the metal is applied in the Laboratory.

VI. How is Platinic Tetrachloride prepared? What important constituent of soils, manures, &c., is determined by its means? Give the nature of the resulting compound.

VII. Give a simple test by which to distinguish Nitrogenous from non-Nitrogenous organic substances.

Sessional Examination—March 27th, 1878.

I. Give the tests for the Alkali metals—Potassium, Sodium, and Ammonium.

II. Ten Grams of the soil of a pasture land analysed for Potash gave ·407 gram of Potassic-platinic-chloride. Calculate the percentage of K O in the soil.

III. Explain the term "*standard solution*," and give the preparation of the following, and the strength of 1 C. C. of each:—

Standard Soda.
,, Ammonia.
,, Sulphuric Acid.

IV. Give a brief account of the chemistry of the Lime-kiln.

V. What is meant by an *empirical* and a *rational* formula? Give examples.

VI. Give a short description of the process to be adopted in estimating the C and H in a food-grain.

VII. How is the Nitrogen of organic compounds determined?

VIII. 1·7 gram of dried farm-yard manure was burnt in the usual way and the products of combustion were received into 20 C. C. of standard Sulphuric Acid; the Acid together with the washings of the bulbed tube required 19.411 C. C. of standard Soda for neutralization. What quantity of N H_3 does the manure contain in 100 parts?

IX. Define Fermentation and Putrefaction, and indicate points of difference between the two processes.

X. An organic substance on analysis was found to possess the following percentage composition. Calculate its formula and give its name:—

C. 78·43
H. 5·89
O. 15·68
———
100·00

BOTANY.

Summer Session, 1877.

Weekly Examination—June 2nd, 1877.

I. Give a full description of the Anther.

II. Classify the following fruits:—

Cocoanut.	Date.
Mango.	Current
Cucumber.	Pomegranate.
Strawberry.	Custard apple.
Peach.	Grape.
Orange.	Pine apple..
Pear.	

III. Give the meaning of the terms Carpophore, Dissepiment, Replum and Anatropous.

IV. What is meant by valvular dehiscence? State the various modes in which it is effected.

V. What characters serve to distinguish a follicle from a legume and lomentum?

VI. Describe a Papilionaceous Corolla.

Sessional Examination—June 1877.

I. Give the meaning of the terms, Diclinous Didynamous, Tetradynamous, Perigynous, Polygamous and Periderm.

II. Describe the structure of leaves and give a brief account of their functions.

III. When is a Corolla said to be—

(*a.*) Campanulate.
(*b.*) Hypocrateriform.
(*c.*) Labiate.
(*d.*) Gibbous.
(*e.*) Calcarate.

IV. State what are implied by the signs given below:—

⊙, ⊙ ⊙, ♂, ♀, ☿, ♃.

Mention the names given to the different portions of a monosepalous calyx, and state what they refer to.

V. Describe the bark of an exogenous plant.

VI. What are Raphides; state the forms in which they exist; mention plants in which they are abundant; and give their Chemical composition.

VII. State what you know about Stomata.

Winter Session, 1877-78.

Weekly Examination—December 1877.

I. Give a description of some of the principal Albuminoids, Fats and Oils obtained from Plants.

II. Give the meaning of the terms Fovilla, Mycelium, Monocarpic and Polycarpic.

III. Mention and describe the methods employed for propagating plants artificially.

IV. State what means are adopted for increasing the quantity and for improving the quality of fruits; and explain how these means operate.

V. Describe the reproductive organs of Ferns.

IV. Mention what you know regarding vitality of seeds.

Weekly Examination—January 31st, 1878.

I. Mention the conditions which are known to render plants liable to disease.

II. Describe the diseased state known as Ergot.

III. Mention what are the means we are advised to employ to prevent the occurrence of plant disease.

IV. Give the Linnean Class and order of the plants placed before you.

V. What do the following terms signify?—

Genus, —Variety,—Race,—Species.

Weekly Examination—March 2nd, 1878.

I. Mention what you know about the fruit of the Papaver Somniferum.

II. Give the Botanical names of the plants placed before you.

III. State what is the character of the flower of the Orders to which specimens numbered 1, 3 and 5 belong.

IV. What plants that you have been made acquainted with, yield useful fixed and volatile oils?

V. Give the characters of the wood of the orange order.

VI. Mention some of the poisonous plants of the orders which have been described to you.

VII. What are the distinguishing characters of the natural order Anonaceæ?

VIII. Give the names of the plants yielding the fruits named below:—

Custard apple.
Wood apple.
Bael.
Citron.
Sweet lime.

Sessional Examination—March 28th, 1878.

I. Name the principal Vegetable Acids, and give a brief account of each.

II. Give the characters of the Crow-foot Family.

III. State what you know as regards the qualities and use of the Mallow Family.

IV. What is Gamboge. Name the plants which are said to yield it.

V. Describe the fruit of the Cruciferous Tribe.

VI. Name the divisions of the Natural Order Leguminosæ, and describe the flower of any one of them.

VII. Give the Orders to which the following plants belong, and state which are poisonous and which yield edible fruits.

Garcinia Mangostana.
Ceratonia Siliqua.
Spondias Mangifera.
Citrus Bigaradia.
Hellebrous Niger.
Pistacia vera.
Mangifera Indica.
Phissostigma venenosum.

VIII. Name the plants which yield: Mastiche, Gum Arabic, Logwood, Kino, Indigo, Liquorice-root and the Red-wood of commerce.

ZOOLOGY.

Summer Session, 1877.

Weekly Examination—June 9th, 1877.

I. Describe the metamorphosis of Amphibians.

II. Describe the carapace of a Chelonian.

III. Describe the fangs of a venomous serpent and show their connection with the poison bags.

IV. Name four Cursorial birds.

V. Give six instances of Lizards.

VI. Name all the venomous and non-venomous snakes that you are acquainted with.

Sessional Examination—June 29th, 1877.

I. Give the grounds on which Amphibians are separated from other Vertebrata.

II. How does the heart of a crocodile differ from that of other reptiles.

III. Classify the following animals: Frog, owl, cobra, turtle, tapir, fox, flying-fox, crocodile, bat, toad, lemur, spider, monkey, bear, rat, duck, python, chameleon, lizard, iguana, salamander, swan, adjutant bird, ostrich, pangolin, crow, tiger, bison, kangaroo, flamingo, pelican.

IV. Give instances of Chelonia, Ophidia, Lacertilia and Crocodilia.

V. Give instances of swimming birds.

VI. Name all the Rodents that you are acquainted with.

VII. Name all the Reptiles and Amphibians that are useful to man.

MENSURATION, AND BUILDING.

Summer Session, 1877.

Weekly Examination—May 22nd, 1877.

I. What is Alumina?

II. How are bricks burned in Madras?

III. What are clinkers, and for what work are they useful?

IV. In ascertaining whether bricks are suitable for the construction of buildings, what characteristics are deemed essential, and what proportion of its weight will an ordinary Madras brick absorb of water?

V. Explain the economy in using thick bricks.

VI. How many bricks can a man and a woman mould in a day?

VII. The interior diameter of a well is 12 feet, and its wall 9 inches thick; how many cubic feet of brick-work will there be, when it is sunk 30 feet below the surface of ground?

VIII. A rectangular cistern is to be made 32 feet long and 12 feet in breadth, to hold 1,920 cubic feet of water; what must be its depth?

IX. What length of teak plank, 12 inches wide and 1 inch thick, will be required to make a box, closed at the top, $3\frac{1}{2}$ feet long, 2 feet wide, and $1\frac{1}{2}$ feet deep, outside measurement?

X. How many running feet of joist will be required for a flat roof, to be put over a room measuring inside 30 feet long by 15 feet wide, and the walls 18 inches thick, the distance between the joists, from centre to centre, being 18 inches?

Weekly Examination—Saturday, June 23rd, 1877.

I. What is the source of the lime used in Madras? Describe the mode of preparing it?

II. What do you understand by quick-lime, and, slacked lime?

III. How can you ascertain whether a stone contains lime?

IV. How is mortar prepared for building purposes?

V. Give a clear description of the method of performing a chain survey, and illustrate it by a diagram showing the position of tie lines, &c.

VI. What is meant by a slope of $1\frac{1}{2}$ to 1? Draw a diagram of a cross section of a canal 30 feet wide at bottom, 12 feet deep, and with the above-named side slopes.

VII. Mention the number of a square feet in a Cawnie, Valie, Bullah, and Goortoor, and state in what Districts these measures are used.

VIII. How many acres are there in a triangular field whose sides are 40, 42 and 58 Chains? (Chain = 22 yards).

IX. There are 4 cans in a swing water-barrow, 2 of which measure, inside, 15 inches in diameter, and are 3 feet deep; the other two are 18 inches inside diameter and 2 feet deep. How many gallons of water will the 4 cans hold? (1 gallon = 277·274 cubic inches).

X. How many bricks, each measuring, with its mortar joints, $9 \times 4\frac{1}{4} \times 3$ inches, will be required to construct a wall which contains 5,000 cubic feet of brick-work?

Winter Session, 1877-78.

Weekly Examination—January 16th, 1878.

I. What do you understand by (1) Eaves, (2) Concrete, (3) Beam, and (4) Aqueduct?

II. Describe the method of constructing a tiled roof.

III. A bed of brick-clay is 3 feet thick, and the area of the bed is 10 acres, what is the value of the clay at 4 Annas per cubic yard?

IV. Give the rule for finding the area of a triangle when the base and perpendicular are given.

V. Find the surface of the walls of a room whose length is 20 feet, 4 inches, breadth 16 feet, 8 inches, and height 12 feet.

VI. How many stones 3 feet long and 2 feet wide are required to pave a yard 100 feet long and 60 feet broad?

VII. If a rectangular plot of ground that measures 100 feet long and 400 feet broad, cost Rupees 200, find the value of a plot of similar land the area of which is 5 acres.

VIII. Find the number of Tons of water, that fall, in the rain, on a field of 10 acres, in the course of a month, in which the rainfall was 18 inches (a cubic foot of water weighs 1,000 ounces).

Weekly Examination—February 5th, 1878.

I. The length of a tank is 25 feet, its breadth 15 feet, and its depth 7 feet; what did it cost digging at 1 Anna 7 Pies per cubic yard?

II. A stone-cutter is engaged to bore 4 holes in a stone, each 15 inches in diameter and 18 inches in depth; how much must be paid him, at the rate of 1 Anna and 2 Pies for 3 cubic inches?

III. State the rule for finding the (*a*) area of a circle, (*b*) the volume of a pyramid.

IV. What do you understand by (1) Gable, (2) Mortar, (3) Basement, (4) Lintel?

V. A circular fish pond is to be made in a garden, that shall occupy just half an acre; what must be the length of the cord by which the circle must be struck?

VI. Name the different parts of a Hipped-roof.

VII. Find how many planks, each 13½ feet long and 10½ inches broad, will be required to construct a platform 54 yards long and 21 yards broad.

VIII. Describe the method of constructing a thatched roof, and state what you know of their advantages and disadvantages.

Weekly Examination—March 9th, 1878.

I. What is Asphalte, and how is it used for forming floors?

II. A verandah 6 feet broad, is to be roofed with tiles; what must be the breadth and depth of the teak rafters?

III. Describe the Prismatic Compass.

IV. The extreme length of a gable roof is 50 feet and its breath from eave to eave is 16 feet, the pitch in the centre, above the level of the eaves, is 6 feet; what will be the cost of the roof at Rupees 12 per square?

V. What is the value of a teak log, length 28 feet, and the girths, taken in 3 different places, 9·57, 6·45, and 4·98 feet, at Rupees 75 a ton of 50 cubic feet?

VI. A room is 15 feet long and 12 feet wide; find the number of paving tiles each measuring 6 × 9 inches, that will be needed to pave the floor.

VII. How many cubic yards of black earth will cover a piece of ground 1·56 acre to a depth of 2 inches?

VIII. Find the number of Casuarina seedlings necessary to plant 2·146 acres, the distance between the seedling trees being 30 inches in the rows, and the rows 36 inches apart.

ARITHMETIC.

Summer Session, 1877.

Weekly Examination—June 5th, 1877.

I. Find the decimal Fraction equivalent to $\frac{1}{2\,7\,3}$, and express the result of the following in decimals:—

$$1-\frac{3}{5^3}+\frac{5}{5^5}-\frac{7}{5^7}+\frac{9}{5^9}$$

II. A metre is 39·37 inches: express an English mile in the metric scale; a metre having measures of deci—, centi—, and milli—metres; and multiples of deca—, hecto—, and kilo—, metres.

III. A gramme weight of water measures 1 cubic centimetre in volume, under certain conditions of air pressure and heat; find the capacity of 1 lb. Av. of water, under the same conditions, 1 kilogramme being equal to 2·2048 lb. Av.

IV. A farmer rents out his land for 3 years, on the agreement that the rent for the second year shall be three-fourth of the first year's rent, and that for the third year, two-thirds of the second year's: the total rent was to be paid at the end of the term, calculating simple interest at 5. p. c. per annum for the first 2 years' rents. If the rent for the last year was £360, find the amount to be paid by the renter.

Weekly Examination—June 18th, 1877.

I. The average depth and width of the furrows of the following ploughs, were:—

Swedish No. 39;	width,	11·875;	depth,	4·5
Do. ,, 2;	,,	10·75;	,,	4·00
Ransomes,	,,	9·00;	,,	3·75

Find the number of cubic yards of soil moved by each of the ploughs in travelling 400 yards in a straight line.

II. Find the *comparative efficiency* of the following ploughs from the data given:—

A Swedish plough in travelling 144 yds. moved 4·16 cubic yards of soil, and its draught was 333 pounds.

A Ransomes plough in travelling 144 yards moved 4·4 cubic yards of soil, and its draught was 176 pounds.

III. In a day's work (8 hours actual work) what area of land will be ploughed, by a plough travelling at an average speed of 2 miles per hour, the furrow being 9 inches wide; 20 per cent. of the time being lost, is turning the plough at the headlands?

IV. The Simple Interest, on a certain sum, for 9 months, at 5 per cent. per annum, is Rs. 150 less than the simple Interest on the same sum for 15 months, at 4. p. c. per annum. Find the principal.

V. A farmer bought 448 sheep at Rs. 2½ each and sold, ⅛ of the lot at a gain of 4. p. c. He afterwards lost 133 sheep; at what rate per cent. profit must he sell the remainder to gain 10 p. c. on the original outlay?

WINTER SESSION, 1877-78.

Weekly Examination—January 23rd, 1878.

I. How many pounds of water does an acre of cholum contain, the crop being 6¾ tons, and the water in the plant being 85 per cent.?

II. The cost per day (6 working hours) of raising water by the unimproved Water-lift is 11 Annas 1 Pie, and that, by the Double Mhote, is 1¼ Annas 10 Pie. The former raises per hour 65 buckets of 20 gallons each, and the latter, 90 buckets of 30 gallons each; compare the cost of the work performed by these two Water-lifts.

III. From an outlay of Rs. 9,600 I realized Rs. 9,900; what do I gain per cent.?

IV. What number of gallons of water would be required to raise a crop of wheat on an acre of land, if the crop must be watered 16 times during growth, each time with a quantity equal to 1 inch in depth over the whole area cropped? (A gallon of water contains 277·27 cubic inches).

V. How many square yards are there in a Cawnie? How many pounds are there in a Hundred weight? How many cubic inches are there in a local Measure?

VI. The pay of a cooly is 5 Rs. for a month of 30 days, he is absent from work 6¾ days during the month; what pay should he receive?

VII. A contractor agrees to supply 20 Candies (500 lb.) of oil-cake, at 5 Rs. 4 Annas per Candy; on the delivery of the oil-cake 800 pounds was found to be inferior and worth only 2 Rs. 8 Annas per Candy; what some must be paid to him?

VIII. A milch-cow gave 441 gallons of milk in a year, and the cost of her maintenance during the period was 116 Rs. 15 Annas; what was the cost of the milk per Madras Measure, if a Madras Measure is equal to 3 pints?

Weekly Examination—February 13th, 1878.

I. Maize seed is sown on the ridge in holes 9 inches apart, and the ridges are 36 inches apart, a single seed is put into each hole; what weight of seed will be needed to sow an acre (80 seeds weigh one ounces).

II. The cost of a Cholum crop, raised on the Farms was Rs. 47-14-0. The yield of fodder from 5 cutting, was 23 Tons 3 cwts. 14 lbs. What was the profit, when the whole was sold at 300 lbs. per Rupee.

III. What must be paid for 3 Candies of Castor-oil cake when Rs. 20 As. 8 was paid for 2,180 pounds.

IV. Divide 2,500 Rs. among 3 men 9 women and 17 boys, and give each man as much as 3 women, and each woman as much as 3 boys.

V. If ¼ of a Farm is worth Rs. 700, what is $\frac{1}{20}$ of it worth?

VI. How much will Rs. 1,200 amount to in 8½ years at 10 Rs. per cent. per annum, compound interest.

VII. What is the interest on Rs. 1,840 from February 13th to May 31st, at 20 Rs. per cent. per annum.

VIII. What is the commission on Rs. 484 at 7¾ per cent.

Weekly Examination—March 16th, 1878.

I. Find the value of 1,500 lb. of maize grain, at 15 measures per Rupee [1 measure = 2 lb. 12 oz].

II. Fresh dung contains about 21 per cent. of organic matter which contains about 6 per cent of ammonia. How much ammonia does an acre of ground receive when manured with 20 tons of fresh dung?

III. The cost of maintaining a pair of working cattle is 6 As. per diem. If the cattle work on 300 days in the year and the hire is 8 As. per day, in what time will the excess of income over cost have covered the original cost (Rs. 130) of the cattle?

IV. If the compound interest of £250 for two years be £20 8*s.*, what was the rate per cent.?

V. A farmer gave for a horse a bill of Rs. 730 due in one month, and sold the horse at once for a bill of Rs. 870 due in 4 months. Required the farmer's gain per cent. reckoning interest at 4½ per cent.

VI. Find the value in Indian money of goods sold in England for £20;—Exchange 1*s.* 9*d.* per Rupee.

VII. A farmer has 200 pounds of cotton lint worth 6 As. per pound and 150 pounds worth 4½ As. per pound. He mixes the two, and sells the mixture at As. 5 per pound; what does he gain or lose?

VIII. Find the value of 234 pounds of cotton lint at Rs. 120-8 per candy of 500 pounds.

42. *Establishment.*—The only change made was in May, when A. Ganapathy Iyer, F.A., the First Master, was appointed to act as Second Master in the Presidency College, and C. H. Tambu Pillay, F.A., assumed the acting duties of the post. The conduct of the whole establishment was generally satisfactory.

(Signed) W. R. ROBERTSON, M.R.A.C.,

July 1878. *Supt., Govt. Farms.*

GENERAL WORK OF THE DEPARTMENT.

Correspondence.—During the year under report the large correspondence of the Department, which has been so steadily increasing year by year, has been maintained; and, notwithstanding the fact that, since the institution of a separate office for the Saidapet Farm in 1874, a considerable amount of work has been removed from it, the number of letters annually issued from my office alone is nearly double of my whole correspondence six years ago. In the following table some of the chief subjects on which advice and information has been sought from me are noted:—

Subject of Question asked.	District whence received.
Checking the work of red-ants which were removing newly-sown seeds ...	Malabar.
A preparation for preserving seeds in granaries from insects	North Arcot.
Tobacco culture	Bombay.
The cultivation of Brisbane grass in this country; and requesting information as to the kinds of grass seeds available in this neighbourhood	Madras.
Whether it would be wise to clothe with grass the surface of land planted with coffee	Nilgiris.
The cultivation of Indigo	Ganjam.
Whether "kanker" may be applied with advantage for growing Indigo ...	Do.
What constitutes a day's work for a plough on dry and on wet land ...	Madras.
The treatment of clay soils liable to contract and crack, and whether Paddy plant is a lime feeder	Ganjam.
Tree planting	Indore.
The use of refuse lime in agriculture	Madras.
The suitability of Buck-wheat for culture in the plains of this Presidency ...	Chingleput.
The advantages of deep cultivation, and of the method of sowing seed in lines over broadcasting	Do.
The means of getting rid of the wild paddy plant growing amongst the indigenous paddy	Tinnevelly.
The means of getting rid of a certain grass, and the best method of cultivating Hariali grass	Chingleput.
Description of chaff cutter best adapted to Estate work and the mode of breaking oil-cake for the use of cattle	Travancore.
The analysis of soils and the best manure for Indigo	Ganjam.
Plans for hastening the germination of seed	Travancore.
The use of lime, castor-oil cake, and salt-petre in agriculture	Madura.
The working capabilities of a wind-power pump at the Saidapet Experimental Farm	Guzerat.
The best plan for starting pasture land in this country	Madura.
Certain blighted Raggy plants	Cuddapah.
Description of a disease by which the cholum heads forwarded was attacked.	Do.
Wells and well sinking in this country	Rangoon.
The working capabilities of a Double Mhote	Hassan District.
Disease by which cholum heads forwarded was attacked, and the precautionary measures to be taken regarding the consumption of the grain by men and cattle	Nellore.
Certain agricultural machines	Madras.
Soils best suited for the cultivation of cotton, Castor-oil, and Indigo ...	Chingleput.
Certain diseased grains	Madras.

2. An epitome of the advice and information received from various correspondents, and of that given by me, which is considered to be worth publishing, will be found in another place.

3. I addressed 167 official letters to the Board of Revenue on various agricultural and departmental matters during the year. The following are some of the subjects to which the letters referred :—

Subject.	Board's Proceedings	
	Number	Dated
A scheme for the establishment of Educational Farms throughout the Presidency	5,223	13th December 1877.
Inviting attention to the suggestion made by the late Cattle Disease Inspector for training "Local Cattle Disease Inspectors" in the School of Agriculture	4,974	12th November ,,
A scheme for training students at the School of Agriculture for employment as "Local Cattle Disease Inspector."	1,125	29th April 1878.
Explanations with reference to the Board's review of the report on my tour in the Coimbatore District in 1875-76	4,548	28th September ,,
Replies to Mr. Wedderburn's remarks on the report of my tour in the Coimbatore District	—	—
Suggestions relative to the publication of extracts from Agricultural Newspapers in the District Gazettes	5,208	11th December 1877.
Suggestions regarding holding an Agricultural Exhibition at Madras in 1878	2,839	16th June ,,
Proposals regarding the necessity for obtaining trustworthy analyses, from England through the Secretary of State, of different kinds of agricultural produce of Southern India	4,064	3rd September ,,
Proposals for the supply of seed-grains to the Ryots	2,810	15th June ,,
Observations about relaxing the rules regarding well-sinking in Nunjah land	—	—
Report on the working capabilities of the Swedish ploughs supplied by the Secretary of State	3,519	27th July 1877.
Pointing out that since the trial of the Rheea fibre cleaning machines at Saharanpur in 1872, a machine has been invented in America which seems to possess the capabilities required by the Government of India	4,853	26th October 1877.
Remarks on proposals for the introduction of Steam-threshing machinery into India in view to the further development of the export trade in wheat	1,069	17th April 1878.
Report on the proposals for a Sewage Grass Farm in connection with the Government Arrack Distillery at Tondiarpett in the Madras District	1,161	1st May ,,
Stating that no benefit would be likely to result from an experiment in the ensilage of fodder being made at the Saidapet Experimental Farm	583	4th March ,,
Furnishing certain information regarding Manilla hemp (*Musa textilis*)	460	21st February 1878.
Suggesting that a quantity of wheat-seed of the best varieties produced in the hottest of the wheat-producing portions of the Central Provinces be procured from the Chief Commissioner for distribution in this Presidency	159	18th January ,,
Remarks on Mr. Shaw's suggestion relative to the cultivation of Buck wheat	4,501	26th September 1877.
Forwarding samples of lint and a plant of a new variety of cotton obtained from Egypt, and suggesting that the samples be placed in the Central Museum	5,271	19th December ,,
Suggesting that steps be taken to procure a report on the nature and mode of cultivation of the Rojofotsy paddy plant in Madagascar	4,633	4th October ,,
Report regarding the insect called "Uru Pucchi," which attacked the crops in the Trivellore Taluq of the Chingleput District	512	26th February 1878.
Report on the insects damaging crops in the Tinnevelly District	566	1st March ,,
Forwarding cholum attacked by a blight called "Smut" and suggesting a recipe for the treatment of seed thus affected for publication in the agricultural portion of the District Gazettes	517	26th February ,,
Observations regarding a fly which is said to be injuring the rice crops in the Tinnevelly District	593	4th March ,,
Views regarding the species of goats or sheep likely to thrive in Burmah	699	15th March ,,

4. At the request of the Collector, I undertook during the year to select, for publication in the Chingleput District Gazette, extracts from various newspapers, such as would be of interest or value to Indian Farmers. These extracts are published in the form of a supplement which is printed in both English and Tamil. When this arrangement was first made, I suggested that the extracts might easily be published in all District Gazettes simultaneously, and thus be a means of diffusing sound agricultural knowledge throughout the Presidency; but the proposal did not meet with the approval of the Board of Revenue, who decided that the question of publishing these extracts should be left to the inclinations of individual Collectors.

5. *Finances.*—The following statement gives an abstract of the accounts of the Department for the year:—

		Rs.	A.	P.	Rs.	A.	P.		Rs.	A.	P.
Balance on the 1st April 1877 ...		...			2,56,331	9	1	*Expenditure.*			
Receipts.								General Supervision	19,251	10	4
Provincial Grant		20,000	0	0				Saidapet Experimental Farm ...	10,995	6	4
Surplus Pound Fund		38,205	8	2				Implement Workshops	2,030	10	5
	Rs. A. P.							School of Agriculture	19,413	7	2
Saidapet Experimental Farm ...	2,352 11 6							Estate Improvements	10,356	4	5
Implement Workshops	1,850 13 8	4,203	9	2	62,409	1	4	Allowance to Surgeon for medical charge	361	10	8
								Paid by transfer	502	12	1
								Balance in favor of the Department on 1st April 1878 ...	2,55,828	13	6
Total ...		...			3,18,740	10	5	Total ...	3,18,740	10	5

The expenditure during the year for *General Supervision* was Rupees 434-4-9 less than what it was in 1876-77. The *Saidapet Experimental Farm* expenditure was Rupees, 10,995-6-4 against Rupees 12,517-10-6 in the previous year; whilst in the *Implement Workshops* Rupees 2,030-10-5 was expended, being Rupees 84-2-5 more than during the last year. The *School of Agriculture* was maintained at a cost of Rupees 19,413-7-2; of this, Rupees 6,868-14-1 was for extraordinary, and only Rupees 12,544-9-1 for the ordinary expenses of the institution; this is the first full year during which it has been at work, and there was only one class under tuition. The expenditure on *Permanent Improvements* was Rupees 10,356-4-5 against Rupees 6,373-12-10 in 1876-77; the increase being chiefly due to the cost of several large works which were carried out to afford labor in the neighbourhood.

6. The total expenditure in the year was Rupees 13,092-1-11 in excess of that of the previous year, the increase being chiefly due to the expenses in connection with the School of Agriculture.

7. The income from the Surplus Pound Fund was Rupees 33,502-1-4 less than in the previous year; whilst that from the Saidapet Experimental Farm and Implement Workshops was Rupees 4,203-9-2 against Rupees 5,099-2-7 in 1876-77; the year was unfavourable to growing profitable crops, whilst the portion on the farm under grass was considerably extended.

8. A detailed statement of the income and expenditure is given in the Appendix.

9. *Establishment.*—During the whole year the Saidapet Experimental Farm continued under the superintendence of Mr. Benson; Mr. Schiffmayer being occupied in supervising the extensive works of Permanent Improvement, and in laying out and commencing the work of the Botanical and experimental grounds attached to the School of Agriculture, as well as in conducting some experiments in the culture and curing of tobacco; the latter gentleman was also absent on 39 days' privilege leave during February and March. The services of either one of these gentlemen are available for extending the work of the Department, whenever it is decided to make use of them. The aid, which both gentlemen have afforded me during the year, has been most valuable. It also affords me pleasure to state that the general conduct of all the subordinate employés of the Department has been satisfactory.

SAIDAPET,
14th August 1878.

WILLIAM R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms.

THE SUPPLY OF WATER TO THE SOIL

AND THE BEST MANNER OF EFFECTING IT IN SOUTHERN INDIA.

Introductory.

1. That the subject of this paper is one of vital importance in this country, every one will admit. In attempting to commence an enquiry into it, I have felt the work to be surrounded by great difficulties. This paper can only be looked upon as a commencement, but it may lead to greater attention being paid to the various agents which I shall mention, other than the simple application of water to the land, which alone has heretofore engaged the energies of our administrators, as the means of protecting the country from drought.

The reason why plants require water.

2. It is a well known fact in vegetable physiology that, excepting carbon, almost the whole of the constituent parts of plants enter into their structures in the form of a watery solution; and in the state of solution, in the form of sap, these constituents circulate through the organism before they are assimilated, after which the water is for the most part evaporated. As plants are apparently unable to absorb water by any other means than through their roots, the importance of an adequate supply of moisture in the soil can be understood; for by the amount so available is the power of the soil to nourish the crop growing on it limited. The amount of water evaporated during the growth of an ordinary farm crop is equal, in cooler climates than that of this Presidency, in amount to about twelve inches of rain; this evaporation goes on during the whole period of growth, and at a greater speed in dry weather than when the air is moist; it has further been calculated that, in England, at least 200 lb. of water must be evaporated for the formation of a pound of dry matter in a plant, and that for every pound of ash constituents 2,000 lb. must pass through the structure of the plant.

Reasons leading to the adoption of "Irrigation," commonly so called.

3. In a climate like that of this Presidency, where the rain falls in such sudden downpours, it is seldom that the soil is able to absorb and retain sufficient moisture for the support of crops throughout the year, and it is therefore necessary to supply this deficiency by artificial means. At the same time, as water never exists, after it has been precipitated on the land, in a pure form; containing then, besides much sediment in suspension, considerable amounts of oxygen, carbonic acid, mineral salts, &c., in solution, and is thus capable either of directly feeding growing plants, or of decomposing the constituents of the soil to which it is applied; its application is advantageous. The practice of applying water to the soil is termed "Irrigation;" and may be defined as a process adopted by the Agriculturist, either to replace in the soil the moisture which plants require for support during their growth, or to fertilise his land. For the former purpose, it is chiefly practised in countries where rainfall is either deficient or badly distributed; for the latter object, it is practised in most countries from the equator to the verge of the temperate zones.

Erroneous ideas existing in India regarding irrigation.

4. Irrigation as a science is as yet unstudied in this country; the generally accepted ideas concerning it are crude, often erroneous, and, still oftener fraught with danger to the country and to the people. Take for instance the following expression of a

leading Irrigation Engineer in this Presidency:—"*Irrigation involves the retention of water on the surface of the soil.*" This is the commonly accepted idea, and the curse of Indian irrigation; the cause of great injury and loss to the country annually; and one that may lead to results more disastrous than the last famine.

5. Irrigation, taken in its widest sense, includes every means of adding to the moisture of the soil, and may be divided into three classes.

Aërial, or the watering of the soil by making use of and developing the powers it possesses for absorbing moisture from the atmosphere, and of retaining the moisture thus absorbed.

Pluviatile, or the watering of the soil by the proper utilization of the rain which falls on it; and also in influencing the manner which that rain is precipitated.

Inundatory, or the watering of the soil by allowing water to flow over or on the land, with a view either of supplying a deficiency of moisture or of adding to the productive power of the land. This latter class of irrigation may be divided into two systems. These systems are—

"Rational" and "Swamp."

In Southern India the two first classes of irrigation are unpractised, even if known; and only one of the two systems of inundatory irrigation is followed, namely, "Swamp irrigation."

Extension of irrigation imperative.

6. It can however be easily understood, by any one who has studied the laws of plant life, and who understands the conditions we have to deal with in India, how our safety from famine lies in the unlimited extension of irrigation over the whole arable area. This is plainly possible; but not on the system at present adopted. To avert the consequences of famine our crops must be safe from utter failure, even if our rainfall is deficient. This can only be when sufficient moisture for their growth is preserved in, or given to, the soil on which they grow, during their time of growth.

7. Inundatory irrigation, even if rationally practised, can never be a certain support where, as in this country, the rainfall varies within such great limits and so often utterly fails to fill the reservoirs, and other stores for the supply of water to lands below them; whilst as long as paddy cultivation is carried on so extensively, the extension of the system is only likely to be injurious to the country at large, although it may produce some increase of revenue and profit to few. Pluviatile irrigation is bound up with Aërial irrigation very closely; the best means of extending the latter being the best for utilizing the rain which falls on the land. It must however also be regarded in another light; that of the work of regulating, as far as the means within human power allow, the precipitation of rain. The only form of irrigation, which can reach every acre of cultivated and cultivable land in this Presidency, is Aërial, and on that form should hope and faith be placed for the protection of this country from the scourge of famine, with its attendant misery to the people and loss of revenue to the State.

The means of effecting Aërial irrigation.

8. AERIAL IRRIGATION can be best effected by the application of organic manures to the soil, aided by deep and thorough tillage. It is however not necessary for me to go into the influences which these agents have on the physical character of the soil, as they were treated most fully by Mr. Schiffmayer in a paper printed in the last annual report of this department. The effects, which the adoption of these practices would have, will be a matter which I must refer to; but seeing that they are, besides being the agents of this system of irrigation, valuable agents in making the best use of rainfall, I will not mention them here.

The means of effecting Pluviatile irrigation.

9. The best means of controlling the rainfall within our reach are, it has been conclusively proved, the increase of vegetation. The simplest means of encouraging the growth of vegetation is to plant and conserve forests throughout the length and breadth of the plains. In this country however the reverse operation is at present going on;

for although no statistics exist which show the area that has been denuded of forest and jungle during recent times, it is a well known fact that, in many localities, great areas of scrub jungle have been cleared. There has been an increase of the area of lands under arable culture in Ryotwar villages alone amounting to 41 per cent. in the fifteen years ending July 1872 in all the districts except those of the Western Coast, Malabar and South Canara; this area, 5·5 million acres, was previously either devoted to pasture or to jungle. The habits of the people, who rarely plant any trees, and never fuel trees, require a far larger supply of fuel than is annually produced by natural causes; this demand has been greatly augmented of late years through the consumption by the railways and by an increasing population. It is presumable therefore that, of the 5·5 million acres brought under the plough, a very large percentage was formerly producing fuel.

Denudation of forests.

10. General experience amply testifies that, within quite recent periods, bridges, constructed with amply sufficient waterway according to the best evidence, have been destroyed by floods unprecedented in height; and the cause of such floods has been easily traceable to clearing of land from scrub in the catchment area which found its vent through these bridges. It is also generally testified that rivers, which in former days ran for five months, now often cease to run after three.

Increased height of floods.

11. It has been established beyond controversion that forests materially affect the precipitation of rain, their influence in this respect being described by Steinmetz as follows:—

"Trees and forests contribute to the formation of springs and water-courses, not only by means of the humidity which they produce and the condensation of vapour by refrigeration, but also by reason of the obstacles which they present to the evaporation of the water in the soil itself, and by means of the roots which, by dividing the soil like so many perforations, render it more permeable and facilitate filtration. Certain it is that the clearance of forests and the consequent drying up or draining of marshes and bogs have caused a material alteration, not only in the entire face of the country, but in the supply of water to the rivers formerly derived from those reservoirs, and in the periodical amount of rainfall and the regularity of its distribution. Many streams throughout the country, which formerly supplied large mills with unfailing water-power, except in the very driest of seasons, are now, with vastly improved machinery requiring less power, frequently unable to work, and almost all are compelled to be supplemented by steam-power to make good the deficiency. Owing partly to this cause, but principally to the modern system of drainage, by which the land is cleared of water almost as soon as it falls, having now none of the ancient reservoirs, in the shape of bogs and marshes, to receive and retain it for future use, all the old water millers complain that the rainfall, however heavy, does them no permanent good. It just occasions a momentary flush, which is rather injurious than otherwise, being in excess of the requisite power, instead of being held in reserve by the marshes and, above all, by the subsoil of the adjacent land. This was formerly, in the undrained state of the country, perhaps the largest source of supply, because it extended over the whole area, and yielded its reserve deliberately and in driblets."

Numerous quotations could be made, showing how the felling and planting of timber influence the rainfall and springs of a country, and also ameliorate or injure climatic conditions; but the following one referring to—

"The Wolf Spring in the commune of Soubey, in France, furnishes a remarkable instance of the influence of woods upon springs. A few years ago this spring did not exist. At the place where it now rises a small thread of water was observed after very long rains, but the stream disappeared with the rains. The spot is in the middle of a very steep pasture, inclining to the south. Eighty years ago, the owner of the land perceiving that some firs were shooting up in the upper part of it, determined to let them grow, and they soon formed a flourishing grove. As soon as they were well grown, a fine spring appeared in place of the occasional rill, and furnished abundant water in the longest drought. For forty or fifty years this spring was considered the best in Clos-du-Doubs. A few years since the grove was felled and the ground turned again into a pasture. The spring disappeared with the wood and is now as dry as it was ninety years ago."

12. In Germany it is estimated that the proportion of forest or woodland required in an agricultural country in order to insure a regular and sufficient rainfall is—

For the interior, 23 per cent.
For the coast, 20 do.

What proportion this Presidency possesses we do not know, but it may be confidently asserted that, if it were as much as 20 per cent., the country would never be so terribly visited as it has been of late years.

13. The question of influence of trees on the total rainfall of any large tract of country is open to doubt. It is however only reasonable to conclude that when great clearances have been made, as is proved by the increase of arable area to have occurred in this Presidency, similar great changes must have resulted in its meteorological conditions. It may here be noted that, in the estimation of competent persons, the rainfall registrations at present made are of little use; as they do not give trustworthy data regarding the rainfall of the districts generally, being generally made in stations where some planting at least has been carried out. We possess no data regarding the meteorological conditions of our bare open plains, where no bush or tree, but only a bare stubble is so often to be seen.

Denudation of the soil caused by heavy falls of rain.

14. No one acquainted with our Indian rainfall, and its nature, can doubt, what the evidence of their eyes proves, that great soil-denudation is going on; enormous amounts of mineral matters, which are removed from the greater portion of the country, going annually, in part to silt up our tanks, but chiefly into the sea. An acquaintance with the power of water in moving substances must convince any one, who has witnessed a fall of 3 or 4 inches of rain in as many hours, that, as it nearly all immediately runs off the land, where the soil is unprotected by trees or crops, the water will carry with it great quantities of valuable substances from the surface in suspension, besides what it dissolves, and carries off in solution. The Ganges, according to Everest, carries to the sea 6,368,000,000 cubic feet of mineral matter per annum, and there is no reason to suppose that other Indian rivers do not, in proportion to their size, carry away equal amounts.

Bare, barren, desolate plains characterise South India in the dry weather.

15. Any one who has travelled through the Presidency, from the southernmost part of Tinnevelly, through Madura, Trichinopoly, Coimbatore, South Arcot, Chingleput, North Arcot, and Salem, cannot have failed being struck by the desolate waste which in the dry weather meets his eye on every side; no plantations, no hedges, only here and there in the fields a solitary acacia, or occasionally around a village a few mango and tamarind trees; nothing to break the force of any wind, or to temper the scorching blasts from the west; nothing to shelter stock from the midday sun; no supply of fuel for the people. The possibility of growing trees generally throughout the country is beyond contention. The area of land available for the purpose, without touching that at present under the plough, as can be appreciated when it is understood that only about 30 per cent. of the total area of the Presidency is *under crop*, is enormous, most of it now lying unproductive, such as the million acres of land annually relinquished, and hill-sides in many localities; large areas, around or near village sites, are but too often covered with a noxious and offensive growth of prickly-pear, which, from the habits of the people, become insanitary and pestiferous, whereas the land might be far better occupied by groves of fruit or plantations of fuel trees.

Enormous area fit for growing trees.

Compulsory planting demanded.

16. Bearing all these facts in mind, it can scarcely but be concluded that general planting throughout the country is imperative and easy of accomplishment; but it can never be done on a scale sufficiently large to have the desired universal results by the State direct, on account of the enormous expenditure that it would entail; in the village communities however we possess a means, willing if ordered, and by their constitution perfectly under control, which could be turned to good account for this great work; and by their means, under a rigid State supervision, general planting might be carried out at very little cost to the State, and without in any way trenching on the liberty of the people, but on the contrary directing their now generally wasted energies to the execution of a work for the benefit of themselves and of their descendants. It is well known that during the dry weather, when most care and

attention is required by young plantations, the general state of mofussil villages is one of chronic idleness. In all districts where there is land, and there are few, if any, where there is not some which is considered to be temporarily or permanently unfitted for agriculture, it should be devoted to arboriculture; the latter being one of the greatest and most potent agencies existing for the renovation of worn-out arable lands.

Grazing should be prohibited.

17. Cattle grazing should be prohibited very generally in all young forests, for fodder would be better raised, as it easily could be, at home, and in this way much young jungle growth should reach maturity; the individual rights of the people must give way in every case to the interests of the State, and, when no hardship can result, should not be taken into grave consideration; in this case it only needs common sense on the part of the ryots to raise fodder cheaply for their stock in a rational manner, and their own and the State's interests will be served. It may here be further observed that one great cause of the ill success that has attended some young plantations is the absence, or the insufficiency of the fences, and the consequent destruction of the young trees by cattle, goats or sheep. Such a state of things need never be for, we possess abundant means of forming stock-proof fences, which at the same time would be fuel producers also.

Good fences required for all plantations.

Landlord should prescribe rotation for his tenants.

18. Compulsory planting of a portion of Government lands should be exacted from the occupiers of any part of them. For as landlord, the State can prescribe the course of rotation to be adopted, and trees should form in this country a prominent place in the rotation, either as topes or as fences grown for shelter and fuel. The extent of and rapidity with which plantations would rise throughout the country, if the State directed it, would be astonishing, and far quicker, cheaper, and more effective, than any direct work could effect. That the people would do it without discussion, except perhaps at first and in a few instances, there is little room for doubt; it is for their own benefit, as much as for that of the country generally, and only needs to be executed to confer an inestimable benefit on Southern India. It might be laid down that for every 100 acres under cultivation, a village should plant and raise annually, on Government land granted them for the purpose, in their own, or, if there were none available in their own, on that of another village, one acre of trees of certain descriptions prescribed by Government. In this manner annually about 300,000 acres of plantations would arise. After a certain number of years, say ten, the percentage of cultivated area to be planted annually might be reduced to one half, and again, after a similar period, to the proportion, which would probably be sufficient to supply the demand caused by felling to supply fuel.

More trees means more manure.

19. Besides the well established facts regarding the effects of trees on climate, it must be borne in mind that abundance of fuel means more manure for our arable lands, as the cow-dung now burnt would be set free, and the ashes of the wood consumed would also swell the manure heap; whilst at the same time the land, which was growing trees, by means of the accumulations of organic matter and of mineral plant-food, drawn from the lowest regions of the subsoil, in the surface soil, would be becoming fit to support crops, which before being planted it had refused to grow. Many trees also produce leaves which are extensively used as manure direct by the ryot, and the increase of such trees is greatly to be desired. Other trees yield edible fruits, which provide large supplies of cattle food in times of scarcity; the growth of these also should be encouraged.

20. ORGANIC MATTER.—The effect of this substance on the soil is chiefly to increase its power of absorbing and retaining moisture; if sufficient supplies be added to ordinary soils they become with good tillage capable of growing fair crops, in seasons of deficient rainfall, which otherwise it would have been impossible to produce. The supply of this class of fertilizing substances in this country would

be very great, if the natural resources of it were properly utilised and a rational system of agriculture followed; but one great step towards the increase of our present supplies would be the increase of the supply of fuel, for all purposes, to such an extent as to render the present system of using cow-dung altogether wasteful. Extensive planting in another way also will increase the supplies of organic matter: for in the leaves of the trees, which will drop from them during their growth, a supply of most available litter exists, which, when decomposed, would form a valuable manuring substance. The proper conservation and use of all household rubbish and refuse, of poudrette, of the carcasses of dead animals, of the offal of slaughtered sheep and cattle, of refuse oil-cakes, of indigo plants after the extraction of the dye, and other substances, now either totally neglected or used for fuel, would furnish enormous supplies of this substance. In green manuring, however, the simplest, easiest, and quickest way of adding to the organic matters in the soil is to be found. The growth of fodder crops, either for soiling in the byre or for feeding off on the land, and the use of litter are also most potent agents for this work. There are in this country ample means of supplying adequate organic manures, and the effects of the addition of such substances to the soil can easily be understood on glancing at the following table:—

Large supplies available.

—	Soil No. 1.		Soil No. 4.		Soil No. 3.		Soil No. 2.		Soil No. 5.		Soil No. 6.	
Air-dried soil contained—												
Percentage of moisture	9·43		6·40		4·13		3·06		·79		·92	
Do. of organic matter	5·46		5·38		3·77		2·90		2·40		1·90	
Do. of absorbed moisture after exposure in a saturated atmosphere.	5·06		3·67		3·17		1·97		·71		·19	
	Pure.	Mixed with 5 per cent. Organic Matter.	Pure.	Mixed with 5 per cent. Organic Matter.	Pure.	Mixed with 5 per cent. Organic Matter.	Pure.	Mixed with 5 per cent. Organic Matter.	Pure.	Mixed with 5 per cent. Organic Matter.	Pure.	Mixed with 5 per cent. Organic Matter.
Took up liquid water, per cent.	34·67	40·16	30·79	38·67	31·58	37·66	25·55	32·70	25·95	36·85	22·92	31·10
Retained liquid water after exposure for 336 hours, per cent.	17·83	22·12	14·81	18·44	14·06	18·20	7·57	9·98	3·60	8·85	2·62	10·39
Liquid water retained equal to rainfall in inches ...	2·35	2·72	2·17	2·72	2·14	2·55	2·00	2·57	1·96	2·79	1·74	2·36
Time required for absorption, hours	8·25	9·50	6·25	6·75	1·50	4·75	1·75	2·25	1·00	1·25	·75	1·50
Increase or decrease of bulk on saturation, per cent.	+ 8·33	+ 3·33	+ 6·66	+ 1·66	+ 4·16	+ ·83	+ ·83	...	— 6·66	— 6·83	— 8·33	— 1·66

NOTE.—These figures are taken from the tables given at pages 21–31 of the Report of the Madras Agricultural Department for the year 1875-76.

21. It will first be noticed that the three soils, Nos. 1, 4, and 3, containing on an average 4·87 per cent. of organic matters, absorbed from a saturated atmosphere an average of 4·63 per cent. of moisture, whilst soils Nos. 2, 5, and 6, containing an average of only 2·4 per cent. of organic matter, absorbed under the same conditions no more than an average of ·96 per cent. of moisture; and although part of this difference must be attributed to the varying chemical composition of the different soils, it is still perfectly clear that soils containing about a considerable amount of organic matters were capable of absorbing nearly five times as much moisture as those containing only half the amount. It was found in another series of experiments that, when 25 per cent. of organic matters was mixed with soils Nos. 2, 5, and 6, their power of absorbing moisture, when exposed at night, was nearly twice as great as when in their natural condition; whilst in the case of soils Nos. 1, 4, and 3, a similar addition only caused an increased absorptive power of 5·8 per cent. The increased retentive power of the soils first referred to was also very marked; for, whilst before the addition of organic matters they absorbed during the night in their natural state only ·65 per cent. more moisture than they lost during the day, after the admixture they gained on an average 1·07 per cent. more than they lost, thus showing that their retentive power was increased nearly seven times. With the soils of better quality, however, as might be expected, the retentive power remained nearly the same, both before and after the admixture.

Power of absorbing liquid water or rain.

22. Referring again to the table, it will be seen that soils Nos. 1, 3, and 4 were capable of taking up holding in their pores on an average 32·34 per cent. of their weight of liquid water, whilst the others could only hold 24·81 per cent. in their natural state; it will be also noticed that the former soils, when mixed with 5 per cent. of organic matters, were capable of holding 38·83 per cent. and the latter (Nos. 2, 5, and 6) 33·55 per cent. Thus, to soils having already a fair amount of organic matters in their composition, 5 per cent. of organic matters added increased their power of holding liquid water by nearly 21 per cent., whilst when a similar amount was mixed with soils poor in this substance the power was increased by about 35 per cent. This variation is in accordance with the experience gained in many countries, that poor soils benefit most from such an addition of manure.

23. Looking at the retentive power of the soils; it will be found that soils Nos. 1, 4, and 3, retained on the average;—

When pure	15·56	per cent. of absorbed water.
When mixed with 5 per cent. organic matter...	19·59	do. do.
Increased retention due to mixture of organic matter	4·03	per cent.
Retentive power increased from 100 to 119.		

Whilst, in the case of soils Nos. 2, 5, and 6, the amount retained was on the average;—

When pure	4·60	per cent. of absorbed water.
When mixed with 5 per cent. organic matter...	9·74	do. do.
Increased retention due to mixture with organic matter	5·14	per cent.
Retentive power increased from 100 to 212.		

Great power as protection from drought.

These results show most clearly what an important agent organic matter can be in ameliorating the poorer soils of this country, and in protecting them from drought; especially those of a medium and light character, which cover so large a part of our arable area. It must not be forgotten that, during the time of experimenting with the soils mixed with organic matters, the average temperature of the air at the hour of weighing was three degrees higher than in the other case.

Probable effect if adopted.

24. DEEP CULTIVATION.—This process can, it may be safely asserted, of itself alone afford to this country greater protection from drought than any extension of Inundatory irrigation; it could, if immediately adopted, place the crops of at least 75 per cent. of our arable area beyond

the withering effects of a slightly deficient rainfall, and would thus enable both the people and livestock to be fed, even though they did suffer from some scarcity.

Mitigation of effects of drought.

25. Of late years attention has been unavoidably drawn to the prevalence of shallow culture in native farming, and to the deleterious effects which it produces, and it has been established beyond doubt that, in time of drought, much of the failure of crops which produces famine is due simply to deficient depth of cultivation, and that, if the arable soils of the country were only tilled to a fair depth, although such failures of rain would affect the production, never, even in the severest droughts, would the country be so fearfully visited as it was in 1876-77. In that year on the Saidapet Farm, it was most clearly demonstrated that, where the land was only cultivated to the inconsiderable depth usually practised by native cultivators, it was almost incapable of producing any crop, whilst in the same field, similarly manured land, which had been worked to a considerable depth, yielded a small crop although during the whole period of growth (eighty-seven days) rain only fell on three days to a total amount of ·16 inch. The following are the figures:—

Nature of Cultivation.	Yield of Straw	Yield of Grain
	Per Plot.	Per Plot.
	LB.	LB.
Deep	11,456	221
Shallow	216	4·5

showing an increased yield per acre of

Straw	2,980 lb. or 621 per cent.
Grain	56·7 lb. or 568 „

in favour of the more deeply cultivated portion.

Increase of absorptive and retentive power of soil.

26. The functions and actions of the soil have been studied in many countries and under many conditions; and it has been established that on the physical condition of a soil in a great measure depends its power of absorbing and retaining moisture; as the growth of plants depends on the presence of sufficient moisture in the soil, this is a most important fact. If a soil be in a finely divided state it will retain far more water than if it be in blocks or bound together in one impenetrable mass, such as is seen in most parts of this country during the dry weather. The power of a soil in absorbing water is chiefly dependent on the extent to which it is divided, and on the presence of organic matter; if it only be in a fine state for a slight depth, it will not be capable of absorbing and retaining in its bulk nearly so much moisture as if it be reduced to a similar condition through a greater depth; in fact its capacity to hold water varies in proportion to the depth of loose friable soil at the surface. A hard closely set soil can hold some moisture but only an amount in no measure proportionate to that which can be taken up by a finely divided one.

Effect of rain in shallow tilled soils.

27. When rain falls, as it does generally in this country, in deluges at rare intervals, the importance of the soil being able to absorb rapidly whatever falls on it can be appreciated. It is too often the case that the shallow ploughed lands of the native farmer are perfectly unable to take up, even a tithe of the moisture which is precipitated on them, producing thereby torrents of water which rush off the land, carrying with them enormous bodies of valuable plant-food, too often at the same time cutting up the surface with gullies and nullahs, and flowing away to the sea—totally wasted; whereas often, had these lands been deeply cultivated, they would have been able to retain nearly the whole of the rain which fell on their surface. On the Nilgiris, in some places in deeply tilled tea plantations, no drainage arrangements are required, for

Effect of deep tillage.

the whole rainfall sinks into the soil. The case is very different with similar soils, tilled by the Badagas, which with a similar rain lose much fine matter washed down to the low levels by the flowing water. On the Saidapet Farm, it has been found that much less water flows off by the drains when the land is stirred to a considerable depth than when it has not been so treated; in many cases it has been possible to keep all the rain which falls on the surface of the land from flowing away, thus both increasing the moisture stored in the soil, and adding to the fertility of the land by the addition of such substances as, ammonia, nitric and carbonic acids, &c., which it is known that rain-water almost always contains in greater or less quantities. The water after being thus absorbed at the surface must filter down through the subsoil and away to the springs to maintain the flow of streams and rivers with greater permanence, and to furnish steadier supplies to the wells, whilst the destructive surface wash would be greatly checked.

Result of deep tillage.

28. It has lately been found, in the great Prairie-States of America, which have until late years been covered with a hard compact sward of grass, and which bear a close resemblance to the shallow tilled arable lands of Southern India, that, since they have been broken up by the plough, a great amelioration of climate has taken place. In the words of the *American Agriculturist.*

Effect on climate.

"As soon as the tough sod has been ploughed, and the soil been mellowed and made absorbent, the rain soaks into the ground instead of flowing off, and percolating through the subsoil, supplies springs, which break out in low spots and furnish water for new rills and brooks. The atmosphere is no longer parched, but becomes moist, and its former extreme variations of temperature do not occur. The climate changes, and the moisture of the air, and the consequent rainfall are increased. A new circulation is established, and the storms and showers are those of a temperate instead of a torrid zone. Facts have shown that these conclusions are correct, and the observations taken in many places near the 100th meridian, and eastward to the Missouri River, indicate a greatly increased rainfall, the increase amounting in many cases to several inches a year. Farmers no longer fear disastrous droughts, and there are few localities, where their business is safer."

Similar results may be expected in India, when deep cultivation is generally adopted, both from the effects described in the above extract and from the increased vegetation which deep cultivation would induce; for with more moisture in the soil the crops would grow longer, be more abundant, and be less dependent on the rains: and in connection with this it must not be forgotten that the amount of dew which falls is dependent on the temperature of the surface on which it is precipitated and on the amount of moisture there is in the superincumbent atmosphere; deep cultivation would render the temperature of our soils far more equable, whilst the increase of moisture in the air from the same cause would be very great.

Results to be expected in Southern India.

29. It may be confidently expected also that, when a greater depth of our arable soils is brought within the influence of the roots of our crops, the outturn in ordinary seasons even will materially increase, for it can scarcely be doubted by any one, who understands the laws governing plant life and the facts of ordinary Indian farming, but that our surface soils are in a very exhausted condition, and are, presumably, much poorer than our subsoils. It must however be remembered that no increase of depth of cultivation can permanently maintain an increase of outturn, unless adequate manuring goes along with it.

Effect on production.

30. There are in this country enormous area of land which suffer more from an excess of water, stagnating in them, than from droughts; on such lands as these, very often deep cultivation may be able to effect a cure, by letting the water through an impervious surface-soil into a pervious subsoil, and thus accomplish all the benefits of subsoil drainage.

31. It is doubtful whether, if deep cultivation of our arable lands were general, the supply of water for tank irrigation would be materially reduced, and even were it the benefits to the unirrigated lands

Effect on supply of irrigation water.

would more than counterbalance the losses of the paddy-growers, whilst it is certain that new springs would appear in many places and old ones become more permanent, and thus the irrigation from rivers and streams would be greatly increased, and the supply of water rendered more certain.

32. This concludes the various means which could be adopted for promoting Aërial and Pluviatile irrigation; the two first and most important means of supplying moisture to the soil.

33. INUNDATORY IRRIGATION, or irrigation in the commonly accepted signification of the term, is, as I have pointed out, the only method extensively practised in Southern India; and it has also been noted that it can never, from physical difficulties in the conformation of the country, be extended to a very large area of it; whilst at the same time the supplies of water on which it is dependent are limited and regulated by the rainfall, the deficiencies of which it is the chief object of irrigation works to eke out.

Inundatory irrigation cannot be greatly extended.

34. Irrigation in the Madras Presidency is practised under wells, under tanks, or with supplies of water drawn from rivers or canals taken off from rivers; the tanks and rivers being all of them dependent on the rainfall for their supplies. The area irrigated from wells on Government land is probably not more than 1,000,000 acres, or about 5 per cent. of the total arable area; a part of this area is the only portion of the Presidency which is at present protected from the effects of a drought, although large areas, under rivers, etc., are partially so.

Small area protected.

35. When irrigating from wells the ryot to a certain extent économises the amount of water he uses for the crops he grows, but he does not make it go as far as he might, and he generally uses far more of the valuable agent than is absolutely necessary. Otherwise than under wells, irrigation water is chiefly devoted to the growth of paddy. The land, which is devoted to this crop, excepting near rivers, consists very frequently of low-lying blocks, often enclosed basins possessing no natural drainage, and to which no artificial arrangements have been provided to supply this defect. Paddy is usually grown in this Presidency under "Swamp irrigation;" enormous bodies of water are generally used in its culture; and on the whole the extension of its cultivation should be discouraged by every means within the power of the State, which are ample; whilst the area now sown with it should be curtailed by every possible means; its culture should, in fact, be confined, as far as possible, to land unfitted for the growth of other crops. That paddy is the bane of South Indian agriculture, there can be little doubt; for the crop is one of a low type, producing unthrifty, wasteful, lazy habits on the part of the cultivators, from the ease with which it can be raised. The increased supplies of irrigation water have led almost solely to the increase of the area under this crop, and, seeing the great dependence now placed on it as a producer of one of the great staple foods of the population, the results which would follow, if a disease or blight were to attack the crop, could not but be most disastrous; and it is surprising, bearing in mind the results of the potato famine in Ireland, where a similar dependence for the supply of the food of the people was placed on a single crop, that the extension of the growth of paddy should be ever advocated, even by those who are ignorant of its agricultural characteristics. The crop does not even produce a good food. It is undoubtedly a fever-producer. It can compare but poorly with many other cereals, maize for instance, as a supporter of life. It monopolises water, which, if applied to other crops, would raise much more food, and give remunerative employment to a greater number of people. It leads to the adoption of perfunctory methods of cultivation, and is generally injurious to the moral and material condition of the people at large. The low character of the crop may be understood when it is known that water, which from standing on land that is unprovided with drainage has become stagnant, is in that state positively injurious to the life of the higher orders of plants, and drainage is seldom if provided for paddy in India.

Want of drainage.

Bad character of paddy as a crop.

Possible disaster from great reliance on one crop.

Paddy has few characteristics to recommend it.

36. It is true that paddy will sometimes yield a fair return on land, submerged with apparently stagnant water to a depth of several inches during the whole time of the growth of the crop, but, when such is the case, the water is not in reality stagnant but is continually changed by drainage, or by other means. The following are the results of an experiment with a crop of paddy grown on land, which was under water during the whole time the crop was growing. :—

—	Area of Plot.	Weight of Grain yielded.		Weight of Straw yielded.	
		Per Plot.	Per Acre.	Per Plot.	Per Acre.
	SQ. YDS.	LB.	LB.	LB.	LB.
Car paddy ...	1,025	331	1,563	853	4,028

In this instance the water in the field was apparently maintained at the same depth, 4 or 5 inches, throughout the whole period of the experiment, it was, however, undoubtedly regularly changed, by natural agencies in some measure, under the influence of the current in the adjoining river, from which the plot was separated only by an embankment a few feet wide, and partly by the volume of water, removed by percolation and subsoil drainage, being replaced by water from the river. This instance is, perhaps, one of the kind from which some persons have formed the opinion that paddy does not suffer when it is liberally supplied with water.

37. The evil character of the paddy crop is well known, and acknowledged, in most countries where it has been largely grown. Mr. Clements Markham remarked, in his report on "Irrigation in Eastern Spain" :—

"The cultivation of rice around the shores of the Albufera was introduced by the Arabs, and was prohibited, on account of its unhealthiness and the waste of water it occasioned, by King Martin of Aragon in 1403 A. D. Permissions and prohibitions have alternated since that time, and Cavanilles recommended the total discontinuance of a cultivation which produced so many fevers and such swarms of mosquitoes. Attempts have been made, near Valencia, to grow rice without irrigation, but they were fruitless.

"It would certainly appear that, apart from its extreme unhealthiness, the cultivation of rice in this country is open to serious objections. The continuous harvests and incessant swamping wear out and enervate the land, and now the use of guano and other manures is essential. The rice is sown in April and May, and reaped in September; so that the swampy land is seldom exposed to the influence of heat, and the stagnant water keeps it in a constant state of saturation, and rapidly neutralizes its fertilizing properties. At present the cultivation of rice is strictly prohibited, beyond certain prescribed limits, and the use of guano as manure is believed to have decreased the pernicious effects of the swamped land, though in what way it is difficult to understand."

38. The results of irrigation referred to are the consequence of the fact that, by the application of water to the soil, the putrescence and decomposition of vegetable and other organic matters which it contains is promoted; and this action often leads to most disastrous consequences, even in such climates as those of Spain, as I have already shown, of North Italy, and of the States of Georgia and Carolina in America, as the following extract, from a paper* published by the United States Department of Agriculture, shows :—

"The rice grounds of Lambardy, though principally lying to the north of the forty-fifth degree of latitude, are almost as destructive to health as those of Georgia and our other Southern States, and the statistics of the increased mortality attending the recent extension of rice-culture in Northern Italy are truly appalling."

And the writer again added :—

"Rice-growing is extremely profitable in Italy, and consequently the temptation to extend it is found irresistible. It was formerly confined within narrow limits by restrictive legislation, but the laws have been modified so as to leave the decision of questions of extension to the

* By George P. Marsh, in the Annual Report for the year 1874.

discretion of the local authorities, who are too often under the influence of large proprietors, and in spite of the remonstrances of political economists and of medical men, the area occupied by rice-fields is, in great proportion, performed by men and women who come down from the mountains for that purpose at the proper season, and this branch of agriculture has acquired such prominence in the eyes of the mountaineers, that the vast alluvial provinces, elsewhere called the "Plains of Lambardy" are popularly known in the Alpine villages, which supply them with laborers, as "*le Risaje*" the rice grounds."

The evils of paddy grain.

39. In the paddy-growing States of America, in the days of slavery, it was found necessary to import new slaves every few years to replace the gaps caused by death from the fevers engendered by working in the low-lying localities, where the crop was grown. In a tropical climate like that of this Presidency, the rapidity with which decomposition proceeds must always have a greater tendency to produce malaria; and, where, as in native paddy culture, irrigation is so often conjoined with the presence of stagnant water, the liability to its production is immensely increased. The subject has attracted the attention of the medical authorities of some of the military stations, and they have in some places requested that paddy culture should be put a stop to, as it certainly should be, within the limits of towns, &c. In the report on the census of 1871, Dr. Cornish remarked :—

"As a public health official my duties lead me to observe some of the effects of bad farming. I have often to notice water-logged lands where no water should be, and a lamentable waste of that great fertilizer, in almost every district where irrigation is depended upon. And very frequently large numbers of the population prostrated by fevers, which but too often arise from excessive soil-moisture and obstructed drainage."

Lieutenant-Colonel Mullins, R.E., reporting with reference to the prevalence of fever in Kurnool, under date 9th June 1873, remarked :—

"No drainage works have been specially estimated for, or carried out in connection with the Madras Irrigation and Canal Company's Canal. * * So far as I am aware no need of artificial arrangements for the disposal of surplus water has been felt." * * *

And then proceeded to say that —

"Whether or not irrigation from the canal has intensified its action where the water-supply has reached, it would seem to be clear that this water can have had practically nothing to do with the existence of the fever."

In this reasoning in a manner which is at least ambiguous.

40. Reporting concerning the effects of the great irrigation works of the Godavari District in causing a great increase in the deaths from fever, Mr. W. Foster in 1873 remarked : —

"The fever has been far more prevalent in later years than formerly." * * *

"The fever is encouraged by a low temperature. But the statistics show that it is not the low temperature alone, but the presence of water in the district which causes high mortality."

"The malaria is more prevalent in damp villages." * * *

"The principal cause of the great prevalence of fever is the presence of a superabundance of water, and that not fresh but stagnant water lying on the ground. Rainfalls and especially heavy rainfall actually clear the ground and do good, but after the rainfall is over the water lies all about the villages in pools and ponds, stagnating and breeding malaria." * *

"The increase of fever in this district within the last few years is due to causes "of a local nature brought into activity by recent changes in the district." I believe that those changes are to be found in the great spread of irrigation and irrigation works within the last few years. The water now lying over the country is far in excess of what it used to be, and the works of irrigation have checked large numbers of small village drains and thrown back the water near the houses. Pools lie and stagnate which formerly were drained off."

Mr. A. J. Stuart, Acting Sub-Collector of the same district, also reported :—

"The great irrigation works have cut across the natural lines of drainage in every direction, and have, by altering the conditions of large areas with reference to drainage, altered their qualities as respects producing fever, in some cases for the better, but in many cases for the worse.

"The evil has unquestionably been aggravated by the action of the irrigation works in throwing large quantities of water over the lands, and so keeping them in a state of saturation.

"Excessive and over-supply of water to irrigated land due to imperfect drainage, or such as the deterioration of lands cultivated dry due to the imperfection of drainage, and caused by the saturation of surrounding lands, though this make no difference in the land revenue, or the water-rate, make all the difference between a rich and contented and a poor discontented cultivator.

"The irrigation works have in many cases swamped them (the village sites) or parts of them and left the villagers to live in a morass."

In a Government Order (No. 1,267, dated the 10th December 1873), on the letters from which the following extracts are taken, it was remarked :—

"The Governor in Council cannot but feel convinced that the deplorable prevalence of fever in the district is mainly due to the cause so forcibly sketched by Mr. Foster and Mr. Stuart the utterly inadequate means of drainage in a tract of country whose swampy nature has been aggravated by the great system of irrigation works. * * *

"At present the gift of financial prosperity, which has been bestowed on the district, is coupled with the curse of disease."

It would appear from these extracts that in paddy cultivation there is to be found, as I have already stated, the cause of much of the fever, which is so fatal in this country. In Northern India similar results have followed the extension of irrigation; although there the crop grown with water is not so exclusively paddy; and besides the losses by fever, the population is in some places either retrograding or at a stand-still.

Drainage the *sine quâ non* of successful irrigation.

41. *Drainage.*—The only way in which the deleterious effects of irrigation can be mitigated is by the provision of thorough and adequate drainage. When none or only inadequate drainage is provided, the injury, which the application of water to the land under a hot sun may do, is enormous, and cannot be easily estimated except by those who possess a knowledge of the functions of the soil; the chief and worst effects are witnessed where the land has been ruined by saline efflorescences; and although the Madras Presidency has not as yet suffered to any extent from this curse of extensive irrigation, the immunity which it has experienced can only be attributed to the fact that the canals, which exist, do so under peculiar circumstances, which are likely to prevent this disaster, or are new works not yet in full operation. As long as adequate drainage is provided or exists naturally, there need be little fear of land being damaged by the presence of an excess of soluble salts; for, if the water applied to the land in irrigation be passed *through* it in an efficient manner, there will never be any cause to fear the gradual defertilization of valuable lands by the evaporation of water, which has been lying stagnant in it, leaving behind injurious salts which have brought up from below.

Removal of soluble salts by irrigation.

Infiltration of water necessary.

42. By thorough infiltration only can the greatest advantages be reaped from irrigation, and the provision of means to effect this are but too generally neglected by the native cultivators, whilst the necessity for providing them is often neither known to many of the former nor to the engineers who provide the water for their use. It must also not be forgotten that, if water be thus passed through the soil, not only will the upward tendency of the superabundant soluble salts be checked, but they will also be carried downwards and away in the drainage, never more to be in danger of being drawn up to the surface to render the soil totally unproductive.

Drainage will economise water.

43. General drainage, and subsoil drainage where necessary, should always accompany irrigation, and, if provided, will be a means of utilizing the water supplied to the utmost: the cost of performing it could be met by increased rates on the land drained, which rates the ryot could easily afford to pay from the increased productiveness of his land and from his greater freedom from sickness. Some districts however possess good natural subsoil drainage, and therefore fever is not prevalent in them even though there is much water used in irrigation, nor have they suffered from saline efflorescences: these districts will require no further provision for drainage. To induce the thorough infiltration of the water used in irrigation, drainage is also required in many cases;

for it causes the water, which is applied to the surface of the land, to percolate through it, instead of merely passing over it.

44. I quote, on the subject of providing drainage, the following remarks of an American* authority:—

"It is rarely that a well drained soil can be injured by a copious supply of water; but one that is not drained may easily be returned quagmire by an excess of it.

"Drainage, therefore, should be the first thing provided before this method of cultivation, let it be complete or partial only, is attempted.

"If the soil is not naturally drained by means of an open and porous subsoil of sand or gravel, tile drains should be laid in such a manner as to carry off the surplus water in the most effective manner."

Drainage generally provided.

45. In the paddy lands of the Southern States, it has become an established practice in good farming, to provide adequate drainage arrangements. In Japan, where paddy is cultivated, it is always grown either on terraced land, or on lands which have been most deeply cultivated, a process, which in a great measure obviates the necessity for special drainage, and that even is provided in many cases in the form of trenches used for regulating the supply water to the fields; and it is clear that the drainage arrangements are good, for, after each flooding, the paddy lands are deeply hoed. I make a further quotation on the same subject, from the paper already referred to at paragraph 38 as follows:—

"All irrigation, except where the configuration of the surface and the character of the soil are such as to promote the rapid draining of the water, or where special precautions are taken against its influence, is prejudicial to health. In most localities the increased dampness of the atmosphere is injurious to the respiratory system, and in others the exhalations from the watered soil and moistened manures tend powerfully to favor the development of malarious influences, and to aggravate, if not to occasion, febrile diseases. There is no doubt the insalubrity of Rome, though certainly not entirely due to this cause, is greatly aggravated by the abundantly-irrigated gardens within the walls of that city."

And then the writer added:—

"Is not the increased prevalence of malarious fevers in the neighborhood of New York and other American cities due in part to the increased extent of market-gardens, and consequently of irrigated lands, in their vicinity?"

In another place he remarked:—

"Malarious influences are exerted not by flowing or even by freely percolating water. It is only when the fluid stagnates on the surface, or in the soil, that it becomes pernicious. In the hills, the inclination promotes the swift flow of water over the ground, or along the canals, and its descent by infiltration is also too rapid to admit it to become a cause of vegetable putrescence. In Central and Southern Europe, almost all the surface of the mountains which has not been swept away by torrents is irrigated through the summer; but fevers and other malarious diseases do not occur in those regions, and they are regarded by many European physicians as especially salubrious even for persons affected with pulmonary complaints."

46. Regarding the practices of irrigators in Eastern Spain, I again quote from Mr. C. Markham:—

"One of the most important parts of the Murcian irrigation system, is that which provides for the drainage of surplus water. The subsoil is a stiff tenacious clay, and arrangements for preventing the accumulation of stagnant water and the formation of swampy ground, are particularly urgent. The irrigating channels, flowing from the right bank of the Azequia Aljufia, terminate at the river, but those from the left bank are led down the valley, and have no natural outlet for their surplus water. Very deep trenches, called Azarbes, are therefore dug in the lower part of the garden of Murcia, which receive, not only the unused water of the channels, but also the drainage of the irrigated land."

And in another place he added:—

"The whole garden of Orihuela rests on a compact bed of clay, so that there can be no natural filtration. Hence the necessity, as in Murcia, of excavating deep Azarbes or drains to receive the surplus water from the land and the numerous channels, and conduct it to the river again to be used for irrigation at the next dam."

* From Stewart's "Irrigation for the Farm, Garden and Orchard."

India alone undrained.

47. In England, and in Germany, where irrigation has perhaps received more scientific study than in any other country, and in France also, in fact in almost every country, excepting perhaps in India, where irrigation is extensively carried on, the provision of drainage arrangements is considered to be the first thing necessary in irrigation works, unless indeed nature has already provided them. The late Marquis of Tweedale's well known advice to the ryots, that they should drain their paddy beds, was in accordance with the best agricultural experience of the world.

Drainage will not impoverish the soil.

48. It may be urged by some that, if the land be thoroughly drained, there will be a tendency to wash out of the soil the valuable constituents of plant-food which it contains. In practice this will never be the case; it is a well known fact that the soil has the power of absorbing and retaining *potash;* which fact, if it needed it, was most fully confirmed by the results of Dr. Voelcker's analyses of the Rothamstead experimental field drainage waters. In speaking regarding *phosphoric acid*, in his report on these analyses, Dr. Voelcker said :—

"The quantity of phosphoric acid in drainage-water, it will be seen, amounts to mere fractions of a grain per gallon, showing that soils have the power of absorbing and retaining soluble phosphoric acid."

And in another place he added :—

"No great loss in phosphoric acid thus takes place by drainage if land is highly manured with soluble phosphoric manures, for the soluble phosphate of the manure is rapidly fixed in almost every kind of soil and rendered insoluble to an extent which prevents the rain passing through the land from removing it to any great extent.

And again he remarked :—

"Whilst phosphoric acid and potash, which are the most valuable components of soils and manures, are retained in the land almost entirely lime, magnesia, sulphuric acid, chlorine and soluble silica, are the less important because more abundant and widely distributed mineral matters pass into the waters of land-drainage in considerable quantities."

The only loss which he found to be at all serious was that of nitrogen, in the form of nitrates; and that only to a serious extent when the land had been manured with a nitrate, such as that of soda, and when its application was followed by continuous wet weather: the results also showed that to apply nitrogen in the shape of farm-yard manure was the safest method. Soda salts it is true are not retained by the soil, and in this lies the secret of the power of drainage to reduce, or guard against those injurious saline efflorescences, which are so common under some irrigation works.

49. THE AMOUNT OF WATER REQUIRED—in irrigating crops is a matter requiring most careful study and experiment. It has not as yet in this country received much attention; but in Italy and France a considerable amount of reliable data exist. The amount required depends on the following points :—

1. The character and state of the soil.
2. The description of the subsoil.
3. The lay of the land.
4. The climate.
5. The object of irrigation.
6. The nature of the crop being irrigated.

Effect of composition.

50. THE CHARACTER AND STATE OF THE SOIL.—The influence, which a difference in the composition of soils has on the amount of water they require and can usefully take up, is very clearly demonstrated by the following figures, showing the amount of water which different soils, when saturated, had absorbed. The different retentive power of the soils is also shown by the amount evaporated in four hours; this also has a most important bearing on the frequency of watering which would be required in either case.

Description of Soil.	Percentage of water absorbed.	Percentage of water evaporated in four hours.
Quartz sand	25	88·4
Clay soil (containing 40 per cent. of sand).	40	52
Loamy soil	51	45·7
Heavy clay (containing 20 per cent. of sand).	61	34·6
Garden soil	89	24·3
Peat or decaying vegetable matters ...	181	25·5

51. I have also shown, in the table given in paragraph 20, the differing absorptive and retentive powers of some soils experimented with here at Saidapet, and it will be allowed that, in determining the amount of water required, the composition and texture of soil must greatly influence the amount of water that can be usefully applied to it. On this subject, a leading French authority, M. Gasparin, states that a soil containing 20 per cent. of sand needs irrigation once in fifteen days, but that, if it contains 80 per cent. of sand, irrigation is required once in five days. The absorptive power of soil is also greater when it is moist and in a mellow condition. And further, a soil requires more water when first brought under irrigation than afterwards, when it has become filled with the slime brought on to it by the water used; this however would not be the case when the land is irrigated with water raised from wells. Plentiful manuring with substances containing large amounts of organic matters, and thorough and deep cultivation of the soil will in most cases be most valuable economisers of irrigation water, just as they are the most powerful means of protecting lands, to which water for inundatory irrigation cannot be brought, from the effects of a deficient or an uncertain rainfall.

Effects of condition.

52. THE DESCRIPTION OF SUBSOIL—is also a most important factor governing the amount of water required for the most economical growth of crops under irrigation. It is scarcely necessary to point out that a course gravelly, or sandy subsoil will allow of almost unlimited percolation, whilst, if it be clayey and retentive, the amount of filtration will be reduced to a minimum. The American authority, whom I quoted regarding the necessity for drainage, states that the allowance for loss by subsoil percolation "should not be estimated at less than 15 per cent. of the supply," and that of course it may be much greater in some cases. I would however here point out that the circulation of water through the soil is as necessary to the plant as is the circulation of air to man and animals, and that therefore it is a gain to have a moderately porous subsoil and thorough drainage; whilst it explains the fact that heavy clay soils are not generally well adapted for irrigation.

Amount of subsoil filtration.

53. THE LAY OF THE LAND.—It can easily be understood that steep land requires much more water for irrigation than land which is nearly level; for in the former case the water, when applied, will run rapidly over the surface, and little will be absorbed, whilst in the latter as it travels but slowly the amount of percolation will be very great. It may not be out of place here to quote Professor Rankine's figures regarding the amount of water which flows off:—

Effect of land being steep.

Steep surfaces of granite, &c. ...	...	Nearly 100 per cent. of what falls.	
Moorland and hilly pasture ...	...	60 to 80 do.	do.
Flat cultivated country ...	...	40 to 50 do.	do.

54. THE CLIMATE.—This has especial reference to the distribution of rainfall, the temperature, the dryness of the atmosphere, and what is mixed up with these the consequent rate of evaporation. The amount of water evaporated from a bare soil is very great, but

Enormous evaporation from the land.

it is still greater when the land is covered by turf or similar vegetation. In Italy out of a daily allowance of a stratum of water from ·62 to ·68 inch in depth nearly 28 per cent. is evaporated. Whereas in this country during a long period of the year there is little or no rainfall, and during which time strong parching winds blow, a very large amount of water must be evaporated, and referring again here to the table in paragraph 20 it will be seen that from a saturated soil (No. 2) during 336 hours' exposure, water, equal in amount to 4·75 inches of rainfall, was evaporated, or an average of ·34 in 24 hours. These experiments were conducted in the month of February when our average temperature is about 76·8°, whilst the average of the year is 82° and that of three hottest months is 86·2°.

55. THE OBJECT OF IRRIGATING.—As I have already pointed out, irrigation may be conducted either for the sake of providing sufficient moisture in the soil for the support of a crop, or to apply to the land fertilizing matters which are to be found in every water which has flowed on the surface of the earth. For the latter purpose enormous bodies of water are sometimes used in the water meadows to be found in various parts of Europe; but there the abundance of water causes no objections to such a lavish expenditure of what in this country is so precious, because so rare.

Moistening or fertilizing.

56. There can be no doubt but that the native paddy-grower, although in all probability he is himself unaware of the fact, consumes such enormous bodies of water in growing his crop in order to protect the soil he cultivates from the effects of the constant removal of crops without the replacement of any manure. This process might be pardonable were there not in the country abundant supplies of manurial substances for the purpose named. As it is, the value of the water used is far greater than that which is obtained from it, and the practice of using it for the purpose of fertilizing the soil should, except perhaps in exceptional localities, be put a stop to, unless the ryot chooses to pay for the full value of the water he consumes. To determine the water-charge, paddy should not be the crop experimented with. The crop, which will produce from the smallest supply of water the largest supply of human food, should be the criterion.

Waste of water in paddy culture.

57. THE NATURE OF THE CROP—being irrigated has a most powerful influence on the demand for water; paddy, for instance, being a semi-aquatic plant, demands far more water than maize. In Italy the allowance during the season is one cubic foot per second of growth for—

304·3 acres of maize	or consuming proportionately	for maize	·695·54	c. ft. of	water.
100 „ of summer meadows.		for summer meadows.	228·57	do.	do.
·43·75 „ of paddy		for paddy	100	do.	do.

In Spain, whilst for ordinary crops the range of area which can be irrigated by a similar supply is from 240 to 1,000 acres, the area if under paddy is limited to only from 30 to 80 acres. In Southern Europe generally the allowance for annual plants is about 7,500 cubic feet per acre for the growing season, whilst for meadows it is double that amount, and in gardens four times as much. These figures show how for different purposes a varying amount of water is required; and taking maize and paddy, both crops which can easily be grown in this Presidency, it will be seen that the former only requires one-seventh of the water that the latter does, whilst its superiority as a food-producer, and the superiority of the food it produces cannot be questioned.

58. The amount of water used in paddy culture in this Presidency has been the subject of some experiments, but sufficient data do not exist to show the most economical amount to apply in ordinary cases. An authority estimates the amount of water used in growing paddy in the Coimbatore District at a volume of 12 feet in depth over the whole surface. The Tahsildar of Karur writing regarding the water used in his taluk, remarked:—

"On the first sort nunjah land Curuway and Sumba paddy are cultivated. Curuway paddy is 120 days' crop and Sumba paddy is 180 days' crop. For Curuway paddy crop there should be 2 inches of water for 30 days and 4 inches of water from the 31st to 100th day in the land.

No irrigation water is applied for the last 20 days. For the crop of Sumba paddy there should be in the land 2 inches of water for 30 days and 4 inches of water from 31st to 160th day. The fields sholud be irrigated daily. As there will be a poor return consequent on the heat produced by allowing the irrigation water applied to the crop on the first day to remain until the following day, it is usual to drain off the water so applied and, to let into the land a fresh supply of water."

This would show that the amount used was for—

Curuway paddy	28 feet
Sumba do.	48 „

but probably half of these amounts are counted twice over, it being common to use half fresh water, and half the water drained off higher fields.

59. In the South Arcot District, in some experiments made in 1866-67, near the river Vellar, with transplanted paddy, water was supplied to an amount equalling 1·86 feet in depth; the rainfall was 40·39 inches, but ·375 feet in depth of this was drained off, showing a total amount of water used of 4·94 feet in depth. This experiment was conducted during the months of September to January, during which period the mean temperature was only 78°.

60. In the same year a more detailed set of experiments were conducted in the Kistna District, the results are tabulated below :—

Number of Plots.	Intervals between watering in days.	Cubic yards of water supplied		Proportionate supply of water.	Yield per Acre in Pounds.		Proportion of different outturns.
		Per hour.	Total.		Plots.	Average.	
16	4	1	2,739	100	2,374	2,249	100
7 and 8	1				2,302		
12	4				2,070		
15	2	2	5,478	200	2,806	2,558	113·74
11	4				2,630		
5 and 6	1				2,238		
14	2	3	8,217	300	3,350	2,665	118·50
10	4				2,342		
3 and 4	1				2,302		
13	2	4	10,956	400	3,310	2,758	122·63
1 and 2	1				2,206		

Taking the figures and arranging them according to the intervals between the waterings, we have the following results :—

Intervals between watering in days.	Number of Plots.	Average supply of water, Cubic yards.		Proportion of water supplied.	Average yield per Acre.	
		Per hour.	Total.		Total.	Proportion.
1	1 to 8	2·5	6,848	142·87	2,262	100
2	13-15	3	8,217	171·43	3,155	139·48
4	10-12 and 16	1·75	4,793	100	2,354	104·07

It would appear from these figures that the least amount used gave the best proportionate return, and that when the water was applied at intervals of two days the results were best: this is what might have been expected, as it would be possible for the land to become to a certain extent dry during the interval; one day between the waterings being clearly too short a period. It may be noted that the amount of water used, which includes the rainfall, varied from 1·70 to 6·79 feet in depth.

61. In another series of experiments, made in the same district in the year 1871, the following results were obtained, which show that at least the larger amounts of water used were injurious :—

Number of Plots.	Supply of water, including Rain.			Yield of Grain.		Yield of Straw.	
	Total Cubic yards.	Feet in depth.	Proportion.	Candies.	Proportion.	Maunds.	Proportion.
1	15,460	9·58	100	$3\frac{209}{640}$	100	450	100
2	18,594	11·53	120·35	$2\frac{553}{640}$	85	430	95·6
3	22,140	13·72	143·22	$3\frac{3}{640}$	91·6	422	93·6

62. In an experiment to determine how much water ryots would take, if allowed to use as much as ever they chose, carried out in the Godavari Delta in 1872, it was found that over 21 acres, including a rainfall of 29·72 inches, they consumed an average of 381,065 cubic feet per acre, or a volume of 8·75 feet in depth.

63. In an initiatory experiment, lately completed on the Saidapet Farm, the following results were obtained; and although the yield of grain in every case was much below what might have been expected, yet the outturn obtained from plots 2 and 5 shows that a yield, probably not much below the average of the paddy crop of the whole Presidency, was produced with a consumption of a volume of water only 32·34 inches in depth including the rainfall.

Number of Plots.	Water supplied, including Rainfall.		Yield of Grain.		Yield of Straw.	
	Total Feet in depth.	Proportion.	Average.	Proportion.	Average.	Proportion.
			lb.		lb.	
1 and 6	2·05	100	375	100	9,746	100
2 and 5	2·68	131·4	801	213·6	8,470	86·9
3 and 4	3·19	155·9	539	143·7	5,445	55·9

64. Bringing the figures given above together, we have—

	Depth of water used.
Coimbatore	12 feet.
Tahsildar of Karur	14–24 ,,
In an experiment made in the South Arcot District, (1866-67).	4·94 ,,
Do. do. Kistna District, (1866-67) ...	6·04 ,,
Do. do. do. do. (1871) ...	9·58–13·72 ,,
Do. do. Godavari do. (1872) ...	8·75 ,,

It will be seen that the only case, in which a moderate amount of water was used, was in the experiment made in the South Arcot District. The yield of grain in that case was at the rate of nearly 1,800 lb. per acre. The amount of water used was a volume of nearly 5 feet in depth; this amount is about what I should, from my experience on the Saidapet Farm, say, was sufficient in most cases. In Italy, as I have pointed out, the amount of water allowed for paddy is about 250,000 cubic feet per acre, or a volume of 5·74 feet in depth. In Spain the amount varies from about 3·50 to 8 feet in depth.

Experiments suggested.

65. It may therefore be safely asserted that the amount of water commonly used in irrigating paddy in this Presidency is in excess of the amount which is necessary, and which is commonly allowed in other countries. To determine the amount of water really required will be well worth the expenditure of a few thousand rupees by Government; such experiments would need to be repeated several times in different seasons and in

every variety of soil; they would require most careful supervision, but would in the results gained be of great value. It was intended in 1872 that such experiments should be made on the Experimental farms, which it was then intended to introduce throughout the country, but as no such farms have yet been, nor seem likely to be, started for some time to come, some special provision might be made for these investigations.

Great aim of irrigation.

66. The great aim in irrigating should be to produce the best results with the consumption of the least amount of water. The lavish way in which irrigation water is used in this country demands serious attention; the loss caused to the country annually is enormous, not only in the smaller area thereby irrigated, but also from the evils that arise from swamping the land.

Principle to be observed in supplying irrigation water.

67. In irrigation it should be always accepted as just that, if a tenant is offered the use of a thing, which would benefit him, and he refuses to make use of it, because he is averse to change or for any other equally invalid reason, he should be obliged to pay for it whether he uses it or no. This principle is adopted by Municipalities with regards to water-supply, lighting, roads, &c., and by the Government with regards to railways constructed with money borrowed on the guarantee of the country. The funds paid away as interest on railway loans are extracted from the ryot; and in this case the possibility of his benefiting directly by the work is not traceable to the cause, as it might be, if irrigation be established as a benefit to the community. Proceeding on this principle it will be always necessary to raise a water-tax either by the acre or by the amount used, the latter by preference, with a minimum rate per acre, which should represent the charge for that quantity which, after careful enquiry, is found to be best adapted for the economical growth of the crop. It should also in determining this rate be accepted as a principle that a man is to pay for what his land can produce under rational management, not for what it does under his, possibly, extremely defective management.

Effect of irrigation on unmanured land.

68. The effects of irrigation in impoverishing the land have been witnessed in most countries; for undoubtedly it does have this effect, unless adequate manuring attend it. Prolonged irrigation unless it be rationally conducted must injure the land. Water, as has been pointed out, stimulates production; increased production causes an increased demand on the stores of plant-food in the soil, which is met by the increased supply set free under the solvent action of water. Hence it is that the estimates formed of the probable outturn, and the results first obtained from irrigation undertakings are found so frequently not to be supported by further experience.

Effects of pure water.

69. In Canal Irrigation especially, it must always be remembered, that it is often doubtful whether the water there used is of much fertilising value, as it is in the case of river irrigation, where the water often contains much silt; so that there is no excuse in this case for the use of excessive amounts of water. The water thus applied is simply a stimulant to the soil, dissolving its inert stores of plant-food, and hastening exhaustion unless manure be applied to replace the substances removed; for, unless the larger amount of plant-food removed be replaced by manure in some form, the process of exhaustion can only be accelerated. The effects, which it has had, are to be traced in most oriental countries. Abyssinia, which in former days supported a large population by means of irrigation, is now reduced to a very low position; the plains of Nineveh and Babylon, now barren and desolate, once supported a great people; in Northern India and in Ceylon deserted irrigation works of by-gone ages exist, deserted probably from the effects of irrigation. The effects of irrigation, in producing malarious fevers is, I have shown, generally accepted in other countries than India; whilst here there can be little doubt about the subject.

Results of over-irrigation.

70. It is a well known fact that plants produced by means of heavy irrigation, are neither so nutritious nor so savoury as those grown in a more rational manner. An Italian authority on the subject says :—

"Moderate irrigation of herbaceous plants accelerates their germination and growth, but it checks the ripening of their seeds, and if water is applied in excess it renders their texture less firm and substantial, and at the same time more subject to decomposition and waste."

Value of irrigation undoubted, but liable in practice to abuse.

71. But notwithstanding all the drawbacks attendant on its adoption, irrigation is, as Von Thaer says, "One of the most useful and important of all the operations within the province of the agriculturist;" especially, I may add, in a country such as India. Whilst far from undervaluing irrigation, when conducted in a rational manner, I may state in conclusion that I consider that it is extremely doubtful whether in this Presidency under the present existing conditions it is advisable to extend the area to which water can be applied, at least without the greatest caution. If instead of spending millions on irrigation works, the State would expend some time and money in endeavoring to ameliorate the practices of its tenants, there might be a hope in some few years that the effects of a deficiency of rain would not have such general and disastrous effects throughout the country as it has now. Let irrigation works go on, improve those already existing, provide adequate drainage where it is required, but let every endeavor be made to improve the condition and circumstances of that portion of the people who depend on the soil for their support, and this cannot be done better than by the diffusion of sound agricultural knowledge throughout the length and breadth of the land.

SAIDAPET, *November* 1878.

(Signed) CHARLES BENSON, M.R.A.C.,
Superintendent of Saidapet Farm.

MANURING, ROTATION OF CROPS, AND FALLOWING;

THEIR ABSENCE IN SOUTH INDIAN FARMING, AND THE CONSEQUENCES.*

Absence of a general practice of manuring.

1. As far, as is known, the practice of *Manuring* is confined almost entirely to the garden lands, which occupy only about 5 per cent. of the arable area: these are said to be heavily dressed. To some portions of the irrigated lands also it is customary to apply manure, but the area so treated is at the utmost small: much of this class of land, however, is annually fertilized by the matters brought down by the water used in their irrigation, both in suspension and solution, and to this fact must the excessive and wasteful use of water in native paddy culture be in a measure ascribed. Of the unirrigated lands of the country, it is however extremely doubtful, whether any area, worth notice, ever receives a particle of manure designedly; and therefore, as these lands occupy 75 per cent. of the arable area of this Presidency, manuring must be said to be generally unpractised by native cultivators. It is however proper to add that most of the land, which is unmanured, is not constantly cropped. The area producing crops is frequently changing, large areas being annually left "waste," and other large areas being relinquished; the outturns obtained are generally small, and of inferior description; consequently the demands on the soil are not very great.

No rotations followed.

2. "*Rotations of crops*" designed for the maintenance of the fertility and productive power of the soil, for the prevention of an inordinate growth of weeds and of the increase in number of the insect and parasitic enemies of the crops, or for economising labor are, it must be acknowledged, in no part of the Madras Presidency adopted. The ryots, it is true, have in an indistinct idea that all crops do not draw similarly on the resources of the soil, and they consequently alternate some very exhaustive crops with others which do not demand so great a supply of plant-food from the soil; but, as their ideas go no further, they have never yet adopted a regular practice of alternating their crops.

Not practised.

3. *Fallowing* the land also, that is fallowing in the acceptance of the term adopted in civilised countries, is an unknown practice, as far as I am aware.

THE USE OF MANURE.

4. The following extract, from Mr. Robertson's report of his tour in the Coimbatore District, may be taken as being generally applicable to the whole Presidency, although perhaps, in some favored, or peculiarly situated localities, it may be found not to agree with customs confined in practice to limited areas.

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*The matter of this paper is taken from a memorandum submitted to the Famine Commission by the department to which I belong.—C. B.

"Almost the whole of the manure the ryot ever uses is expended on the land irrigated from wells. It consists chiefly of village ashes, and weathered sun-dried cattle dung, but the general practice in manuring this description of land, is to fold sheep on it during the night, the animals being allowed during the day to graze elsewhere. The efficacy of the practice depending upon the quantities of excreta, solid and liquid, deposited on the land by the sheep during the night."

5. Another quotation shows how easily people may be misled by the assertions of the ryots themselves regarding the use of manure. After cross-examination for some time, the following admissions were made by the Coimbatore ryot, who farmed 20 acres of land, and who at first would not acknowledge the absence of any general practice of manuring.

Q.—Then, it is evident that you will manure only 100 square yards of land in two days, in a month 1,500 square yards or in a year less than 4 acres. How do you manure the remainder of your land?

A.—We cannot manure it, it goes without manure.

Q.—But you said that you manured your land, whereas, the fact appears that nine-tenths of it is unmanured. How do you explain this?

A.—I have 8 acres of garden land and this gets the whole of the manure. I never manure dry land. Dry land is never manured, unless when the cultivator only has dry land, in which case, his dry land gets what manure he has.

Q.—Then you mean to assert that dry land is never manured, except under the exceptional circumstances you have mentioned?

A.—Yes. All the manure goes to the garden land, the dry land is cultivated without manure.

Want of careful investigations.

It is probable that most of the assertions, of those who believe that the use of manure is extensively practised in native farming, rest on no better grounds than the unscrutinised statements of ryots made as related above. Persons who have not had an agricultural training will always be liable to be misled by the positive declarations of the cultivators with whom they come in contact, whereas it is often necessary to apply a most close and searching scrutiny before the real facts of the case can be discovered. In this country there never has existed a body of educated agriculturists; district officials rarely have time, or understand the necessity for close investigation into such subjects; nor have they generally any agricultural knowledge but what has been learnt from native farmers, and are easily led to proclaim as general practices, systems which on enquiry are found to be followed only to a most limited extent.

Information on the subject.

6. If we bear these facts in mind, the following quotations, from reports written in 1865, in reply to a circular of the Board of Revenue calling for reports on the systems of agriculture followed in the different districts, show on what substances, but not to what extent, native cultivators chiefly rely for fertilizing their lands: the Collector of Ganjam said:—

"Lands are usually manured with animal refuse, village sweepings, and the soft deposits of tank beds, &c. Flocks of sheep and cows are also penned over the fields. Refuse from the gingelly oil-mills, commonly called oil-cakes, is used to enrich lands planted with cane, it is essential to a good crop. Manuring paddy lands with branches and leaves of trees is not usual in this district."

This district is almost the only one in which the use of refuse oil-cakes as manure is referred to; and as sugarcane only occupies ·68 per cent. of the arable area, the practice is not an extensive one.

7. The Collector of Vizagapatam remarked:—

"The manures are of chiefly cow-dung, wood ashes, refuse of indigo-vats and oil-mills, but the most effectual manures are the droppings of sheep and goats which are secured by penning the flocks at night on the land requiring to be manured."

8. Mr. J. W. B. Dykes, Collector of Nellore, stated:—

"In the haphazard cultivation of the red soils, as might be imagined, manure is unknown. The whole of the manure that can be scraped together is there put in the gardens."

9. The Collector of Cuddapah remarked :—

"Every ryot keeps a heap of farm-yard manure near his house, and he pollards all the trees in his holding for the leaves and branches. The *leaf-manure* he uses for wet lands, laying it down in considerable quantities after the land is ploughed. The leaves are quite fresh and recently cut. They ferment and decay in the soil. The ryots even buy leaves for manure. They are generally leaves of neem and trees other than fruit-bearing trees. The ryots also use extensively the refuse of the indigo-vats for manure."

It is extremely doubtful whether the system of pollarding trees is very extensively practised, and, even if it were, the total amount of manure thus supplied would be but small. There are many trees and common ones, which do not yield any leaves which it would be worth while to cut, and there are others to which pollarding would be destruction. It must not be forgotten that it is nowhere noted in the above extract, what proportion of the total area of irrigated lands are manured with leaf manure. The Collector also added :—

"The *farm-yard* manure is applied to dry soils and to garden lands. It is, as I have said, stored carefully, and bratties for fuel are not so exclusively used in this as in other districts."

The reference to the non-use of cow-dung as fuel is difficult to understand ; if bratties are used almost exclusively, then the dung-heap referred to at the beginning of the extract will not be of much account. It may be also noticed that, in the adjoining district of Bellary, Mr. A. Hathaway reported :—

"It is to be regretted that the universal practice of using cow-dung for leping the floors of Hindu houses, and for fuel, prevents the use of a very fertilizing ingredient.

"The cultivating population are unacquainted with chemical or mineral manures, although in some parts of the district, where there are mountain streams, as for instance at Kona Uppalpad, they have not failed to appreciate the benefit derived from the drainage of hills, which, in the instance specified, are composed to a great extent of limestone.

"The productive powers of wet lands, for paddy and sugarcane is maintained by manuring them, at the rate of 15 to 25 bandy-loads per acre, with the contents of dunghills, in which are amassed, house-sweepings, cow-dung, ashes, and other refuse, by ploughing into the ground leaves and branches of different kinds of trees, as also of "Anumulu," a kind of bean (*Dolichos lablab*) which is purposely grown in the land intended for paddy ; and after the former is reaped, the stump, creepers, and the remains are forced in by a plough, and then moistened to fertilize the soil, and, lastly, flocks of sheep are folded at night on the land for four or five nights."

Here as elsewhere no statement is made regarding the area annually manured. The Sub-Collector of the same district remarked :—

"The practices of manuring and penning a flock on black cotton soil are not everywhere followed, but in some villages lands are manured and sheep penned on them * * *. A flock of sheep is penned on the ground, it is then inundated for five or six days, then ploughed lengthways and crossways. After a lapse of eight days again ploughed, and then manure by the leaves of the Cassia auriculata, wild indigo, Indian beech and other trees are thrown in at the rate of 50 bandies per acre ; again ploughed, and manure consisting of cow-dung, house-sweepings, &c., is thrown up."

As will be seen from the first part of the extract, such liberal treatment is only followed in some cases : probably very few. Paddy lands, it will be noted, are the only ones which are manured by sheep-folding, and that only in some cases, probably also very few.

10. Mr. Minchin, Collector of Kurnool, reported :—

"Paddy lands are manured with animal refuse ; but more generally with the branches and leaves of trees. Garden lands are invariably cultivated most highly, the sweepings of the villages and cattle manure being used. Flocks of sheep are also penned over the fields for the purpose of manuring them. The richer dry fields, when situated near the village, are treated in the same manner as the garden lands * * *. In the dry cultivation of those taluks, manure is never used, as all the available supply is required for the more remunerative irrigated lands."

From this it may be concluded that the manuring of unirrigated lands is the exception and not the rule.

11. The Collector of North Arcot said :—

"Manure is used more or less liberally in proportion to the circumstances of the ryot. It is most diligently collected and stored throughout the year, and consists of all the cow-dung not used for fuel and domestic purposes, of wood-ashes, house-sweepings, with straw and large quantities of leaves admixed."

In this case, it may be remarked, that the general custom of using cattle dung for fuel, must prevent there being much available for manuring. The Collector added :—

"There is another method of manuring very commonly combined with that just described A flock of sheep and goats is penned in the field during the night, and paid for at the rate of 2 Annas to 2½ Annas per 100 with rations to the shepherds. A flock from 300 to 500 sheep will thus manure a cawnie of land in three or four nights. I may mention here that in some parts the alluvial deposit in the beds of tanks is made use of as manure, especially in light upland soils. Unlike the Chinese our ryots have no idea of utilising sewage, and in fact express great disgust at the proposition."

And again :—

"The only attempt ever made to qualify such soils by the addition of lime and other foreign ingredients is, when, as already noticed, they are top-dressed with the alluvial deposit from tank and river-beds."

The Acting Head Assistant Collector of the same district remarked :—

"Sewage is never employed, and indeed the ryots appear to have no idea of the value of either this manure nor yet of bones or decomposed animal matter. A dead beast is either left outside the village for the vultures, or eaten if edible by the village Pariahs, and the bones are left where the animal died, no one appearing to have the least idea of the use to which they might be so profitably put."

12. Mr. Banbury, Collector of South Arcot, replied regarding the use of manure :—

"As regards nunjah land, twigs and leaves of trees, and shrubs, refuse of indigo and ground-nut, are used as manure, the stubble is also ploughed in. For dry lands, cow-dung and sheep-dung, as well as the sweepings of the houses and backyards are employed ; but the practice most usually adopted is penning sheep in various portions of the field to be manured."

Seeing that in many cases the first object of the ryot is to manure his garden lands, it can be easily shown that there is very little manure left over for the unirrigated land.

13. The Collector of Trichinopoly reported :—

"In wet lands under river irrigation, manure is but seldom used, as the alluvial deposit left by the Cauvery water is considered to be sufficiently fertilizing. In the case of lands situated remote from channels and of those watered from the surplus drainage of other fields and the other localities, fifty bundles of leaves valued at 8 Annas, and penning flocks of sheep at an average cost of 8 Annas per acre, are the means adopted to manure the soil. A portion of the indigo crop raised is not reaped, but ploughed up with the earth and trodden in.

"A cawnie of land is considered to be well manured if 1,000 sheep are penned on it for five or six nights consecutively. As it is only possible to fold sheep usefully on the land with the object of manuring during about one-third of the year at the utmost to manure 100 acres of land annually, a stock of between 4 and 5,000 sheep would be required."

14. The Collector of Salem remarked :—

"The means used for fertilizing soil are manures, viz., cow-dung, night-soil, leaves of different plants, refuse of oil-mills, ashes, &c. The wet lands are liberally treated with rich manure ; green leaves are much used, and also the refuse from indigo factories ; sheep and oxen are penned at night on wet and dry lands at a certain payment per head to the owners. Leaves are used as manure for wet lands but not for dry lands."

15. Summing up this evidence ; it is clear that for the purposes of renovating or maintaining the condition of his land the ryot places reliance chiefly on *Sheep-folding*, and to a certain extent on the folding of cattle on the land. It is also clear that, as has been already stated, the garden and irrigated lands receive the chief part of the manure, it being only in the case of rich unirrigated fields, lying close to the villages, that this class of land ever receives any thing to replace the

substances taken away from it by the crops grown and removed. Of other manural substances made use of, the following are the chief:—

Leaves of trees, &c., of sorts.
Village ashes and sweepings.
Indigo vat refuse, to a limited extent.
Refuse oil-cakes, in some places.

But it must not be forgotten that the use of—

Animal refuse,
Bones,
Mineral manures, such as saltpetre, lime, &c.,
Green-manuring,
Human excreta,

is a thing almost unknown; whilst at the same time the native cultivator uses as fuel enormous quantities of most valuable manure in the shape of

Cow-dung cakes or bratties.

He also neglects to conserve by the use of litter the

Urine

of his livestock, when stalled at night.

16. It is surprising that, although he appreciates the value of sheep-folding, the ryot has never adopted the practice of raising green food to be fed off on the land by livestock. At present his livestock feed during the day anywhere, where they can find a bite, being penned on the land at night only, and in consequence their excreta are of poor quality, as they feed on innutritious coarse herbage only, receiving no addition whatever to what they can pick up.

Want of food for sheep.

17. Assuming that the whole sheep stock of the Presidency are, whenever the conditions of the season permit, used for folding on the land, and that with every pen of 20 sheep 3 cattle are tied outside; calculating three head of cattle as equal to 15 sheep for manurial purposes; and assuming that it requires 6,000* sheep to manure an acre of land fairly in one night, and that folding can only be profitably carried on during one-third of the year (four months); there being about 11·8 million head of sheep (including the cattle usually tethered along with them) available for this purpose, about 240,000 acres could be manured in this manner annually throughout the whole Presidency, or very little more than 1 per cent. of the total area of crops raised.

Area manured by Sheep-folding.

18. The amount of *cattle manure* used, besides that already included above, can be but very small, for the consumption of bratties as fuel is enormous, and the accumulation of cattle manure for application to the land not at all general. It may not be out of place to observe herethat, as shown during the fifteen years ending July 1872, the rate of increase in thenumber of livestock, estimated as cattle (five sheep being taken as equal to one bullock), is even in ordinary times, unable to keep pace with the demand for manure by the increase of arable lands; for in the fifteen years referred to, the increase of stock was only at a yearly average rate of ·32 per cent., whilst that of the arable land was at the rate of 2·75 per cent., so that there has been about 17·5 per cent. decrease during this short period in the number of livestock maintained per acre of cultivated land. The number of livestock per acre of land was never sufficient to supply manure for more than a very small portion of the arable lands, and any diminution of it is a matter of most serious import.

Decrease of available manuring force.

19. *Village ashes* are said to be used considerably: this may be doubted by any one acquainted with the appearance of native villages, the sites of which are generally rising gradually above the surrounding land, and are continually being added to by the daily sweepings of the

Great waste of ashes.

* See para. 13 above.

houses, &c.; nor can ashes be highly prized by the ryot as a manure, for it is possible at Saidapet to purchase 8 or 10 cwts. of them for ½ to 1 Anna in the neighboring villages; this is close to Madras, where, in the gardens surrounding it, manuring is carried on to a much greater extent than is common in other localities. It is also well known that Municipalities experience great difficulty generally in getting rid of ashes and other refuse; many employing these ashes for the purpose of filling up pits and lying low lands.

20. The use of the *leaves of bushes and trees*, the chief of which are as follows, is practised to some extent on paddy land :—

English.	Tamil.	Telugu.	Botanical.
Madder	Yercum	Jilladu	Calotropis gigantea.
	Avarai	Tanghedu	Cassia auriculata.
Indian beech	Poonga maram ...	Kânoogoo	Pongamia glabra.
Wild indigo	Kôllukavaday	.....	Indigofera paucifolia.
Margosa	Vaypa maram	Vepa	Melia Indica.
Wild croton	Caat Amanuck ...	Adivie Amida ...	Jatropha curcas.
Conessi bark tree ...	Veppalei	Codaga-palla ...	Wrightia antidysenterica.

But it may reasonably be doubted, whether a large percentage of the 5 million acres annually sown with paddy ever receives any such, or any other manure. Mr. Robertson found that in Coimbatore only two or three cart-loads (1,000 to 2,000 lb.) of leaves, costing from 4 to 8 Rupees, were annually applied per acre: generally when used, the leaves are applied at the rate of about 500 to 2,000 lb. per acre, and that over the very limited area for which at present the leaves, &c., available can possibly suffice, even were, as is not the case, all of those procurable used; but by far the greater portion of our paddy is, as has been said before, believed to be generally unmanured, except by the water used in growing the crop.

Waste of valuable manure.

21. *Indigo-vat refuse* is used in some places for manure, but is also largely used as fuel: indeed I have been informed by a firm of manufacturers that in the Vizagapatam District they suffer from inability to get rid of the refuse, while at the same time they complain that the indigo plant grown by the ryots is rapidly deteriorating in size and quality. This is typical of the custom which obtains in this Presidency in the non-use of manure and carelessness of preserving and conserving every particle which can be procured. Even were all the indigo refuse of the country used for manure, the area so manured would not be great; probably not a tithe of the area annually sown with indigo is at present manured with refuse from the vats.

Enormous export.

22. The use of *refuse oil-cakes* as manure is not at all largely carried out, they being chiefly used as fuel, or for cattle food. There is also an enormous export of these substances to Ceylon; the average export from the port of Madras alone during the last three years having been over 47,000 cwts. annually; whilst a similar export goes on to the coffee planting districts of Travancore, Nilgiris, and Coorg. During the year 1876-77, 194,518 cwts. of the dregs of gingelly oil were exported from the Presidency chiefly to Ceylon, whilst the export of oil-seeds is put down as follows :—

	cwts.
Essential	15,224
Castor	529
Linseed	2,051
Mustard and rape	44,072
Till or gingelly	449,600
Other sorts	89,282
Total ...	600,758

Whilst there are also about 1,407,500 gallons of oil also exported, or about 150,000* cwts.; thus making a total export of the products of oil-seed crops of about 950,000

* It must not be supposed that I look upon this export of oil as detrimental to the country; if the oil alone were exported, nothing could be more satisfactory.—C.B.

cwts. The total area under such crops is returned as being 1,197,000 acres, so that probably at least 60 per cent. of the produce of the country in oil-seeds is now exported, and a large portion of the remainder is sent to the coffee districts as manure, very little being kept in the plains for such purposes.

Great waste.

23. This completes the list of substances which are sometimes used by the native farmers as manure; there remains to note those which are seldom if ever made use of, although present in many places in great abundance. To commence with "*Human excreta*;" it has been calculated that the manurial value of these is about Rupees 2-8-6 per head of population per annum, but poudrette is only used to a very slight extent in or near the larger towns, Madras, &c., and on the Nilgiris by coffee planters; the whole of this valuable substance being almost always wasted, whereas it might be easily collected, defecated, mixed with ashes, and formed into a valuable manure, perfectly free from obnoxious characteristics.

Great value of substance.

24. ANIMAL REFUSE is also a neglected means of preserving the fertility of the land. Mr. Robertson has calculated that in the city of Madras alone the value of the blood and offal of the cattle and sheep which are annually slaughtered, is "in round numbers 25,000 Rupees, less cost of drying the blood; and this refuse should suffice to manure highly 2,000 acres of arable land every year." And further he arrived at the conclusion that there are annually slaughtered for human food in the Presidency about 1¼ million goats and sheep. It is also well known that the carcasses of animals, which die of disease, are not utilised as manure. According however to the official returns, the number of cattle reported to have died in the Presidency, during the years 1873-74, 1875-76, was 507,303, and 710,153 respectively; these may be valued at least Rupees 1-4-0 each for manure so that the annual loss in this respect is enormous.

Large amount available.

25. BONES are amongst the different portions of the carcasses of livestock, which are never collected for the purpose of manuring the fields of the ryots; there is however a considerable export of them to the coffee districts; much also going to Ceylon. Estimating the cattle which die or are killed for food annually to yield 25 lb., and the sheep 7 lb. of bones; it may be safely said that over 12,000 tons of this manure are lost every year to our arable lands.

26. MINERAL MANURES, such as lime, saltpetre, &c., are never used by the ryot, although often available at prices sufficiently low to justify their use.

Not practised.

27. GREEN-MANURING, that is the growth of crops to be ploughed under as manure is not practised; it is probable that this method is one of the best, and most easily applicable, for adoption in this country.

Non-use of litter general.

28. Closely connected with his practice of using cow-dung *bratties* for fuel, is the negligence shown by the ryot in his endeavors to preserve the urine of his cattle, for the use of litter, excepting leaves to a limited extent, where cattle are housed, is almost unknown, so that all the urine of cattle so treated is lost; as urine forms the most valuable part of the excrements of the ox, this causes a most serious loss, and one which might, to a great extent, be checked by the influence of Government.

29. The crops, which especially require manure, and which generally receive it from the native cultivator, are the following; the area under each in the Presidency is also given:—

	ACRES.
Wheat	19,000
Tobacco	88,000
Sugarcane	33,000
Betel-vines	17,000
Chillies*	105,000
Plantains*	33,000
Sundry other vegetables*	163,000
Total ...	458,000

* The manuring of these is not always carried out.

or about a fiftieth part of the arable area. These crops, it must be remembered, occupy the greater part of the land which is cultivated under well irrigation, which is as has already been stated the chief recipient of the manure at present made use of in native cultivation.*

ROTATION OF CROPS.

30. The following quotation, from Mr. Robertson's report of his tour in the Coimbatore District, may on this subject also be taken as a reply, applicable to the whole Presidency:—

"Nothing whatever is known by the ryot regarding "rotation of crops" as this is understood in other countries; I say this advisedly, for I have taken some trouble in making enquiries. In some places, I was informed that the ryots did follow a rotation in their cropping, but, on making further enquiry, I learned that the so-called rotation, existed only in the imagination of my informants. In one place, where I made enquiries, I was informed that the so-called rotation was; cholum followed by cumbu in each year, repeated again and again as long as the land would continue to bear a crop. The ryots of course understand that certain crops make a greater demand on a soil than others; for instance, it is common to crop land with sugarcane only every second year; while, land is cultivated with cotton in successive years, over a long period."

31. In support of this I make the following quotations from the reports on the agriculture of the different districts, already referred to at para. 6. Mr. D. F. Carmichael, reporting of the Vizagapatam District, remarked:—

"With the exception of sugarcane, which is never grown on the same land for two years running, the practice of rotation of crops is unknown in this district."

Sugarcane it appears is alternated only with other graminaceous plants, so that this even is not a true rotation.

Mr. J. R. Cockerill, with regard to the Cuddapah District, said:—

"As regards rotation of crops, there is no established system amongst the cultivating classes."

From Bellary, Mr. A. Hathaway reported:—

"For rice or paddy * * no system of rotation is known. The early crop is followed by the second year after year. On sugarcane lands, however, crops of rice and sugarcane are raised in rotation, or alternately every second year."

Further on referring to unirrigated lands, he added:—

"The only approximation to a system of rotation is as follows:—

"First year—Cotton and koraloo sown together, one row of cotton to two or three of koraloo; or sometimes the former alone, or white cholum, and sometimes mixed with Bengal-gram in the proportion of five rows of the former to one of the latter.

"Second year—White cholum alone are mixed with Bengal-gram.

"Third year—White cholum and wheat.

"As a general rule, cotton is sown only once in three years on the same land, as it is alleged that this crop greatly exhausts the productive qualities of the soil and engenders much heat whereby the land is disqualified from producing in succession any good crop."

Again in referring to an inferior class of soils, he remarked:—

"There is no rotation system acknowledged."

At the same time Mr. J. Fraser, reporting from the Godavari District, said:—

"After the early sown dry crops are reaped, horse-gram is generally cultivated as a second crop." * * * "With indigo no other crops are grown in rotation." * * * "Black-gram or green-gram and cucumber seed are sown together with cholum seed." * * "No other crops are grown in rotation on the ground on which red cotton is cultivated."

* I give in the following table an *estimate*, which I have made, regarding the area in the Presidency now manured, and that which could be manured by the proper utilization of the resources at present available.

Source of Manure.	Probable Area at present.	Area which might be.
	ACRES.	ACRES.
Cattle	125,000	1,250,000
Sheep	95,000	200,000
Village ashes and sweeping	15,000	1,000,000
Poudrette	5,000	125,000
Indigo refuse	20,000	300,000
Leaves of trees	25,000	50,000
Oil-cakes and cotton-seed	10,000	600,000
Green-manuring	None.	1,500,000
Animal refuse	None.	260,000
Bones	None.	65,000
Mineral manures	None.	100,000
Total Acres annually manured ...	295,000	5,450,000

This is of course only an estimate, and one made with very defective data; but I am convinced that manure could be easily found to dress at least 20 per cent. of our arable area ($22\frac{3}{4}$ million acres) annually, whilst at present, I do not believe that 2·5 per cent. are so manured. Mr. J. F. Price, then Head Assistant Collector, North Arcot, remarked :—

"There is no rotation of crops in this division. The same process goes on from year to year, and so long as there is rain the ryot cultivates the crop which pays him best, and for which his land is best suited."

In South Arcot, Mr. Banbury reported :—

"As regards nunjah, in certain localities ragi is first raised and then sumbah paddy is sown, this thus goes on from year to year."

Mr. G. L. Morris, Collector of Tanjore, said :—

"The system of cultivating crops by rotation is not known as regards wet cultivation, the same crop being always cultivated on the same lands. In the case of dry lands ragi and varagu are the only crops, which, as a general rule, are cultivated alternately with other crops."

In this district, it appears to be the custom to alternate ragi with another gramina-ceous crop; this, it is scarcely necessary to observe, does not constitute a true rotation. Mr. Macdowell, from Trichinopoly reported with reference to unirrigated lands :—

"In valuable lands, any one of the higher descriptions, viz., ragi, cholum, and cumbu are grown first, and varagu afterwards, or *vice versâ*. Pulses of different kinds are sown together with the higher description of dry cultivation."

Mr. Arbuthnot reporting from Salem, said :—

"Rotation of crops exist in this district. In wet and in dry garden lands various sorts of paddy are sown in rotation." * * * "When the water is insufficient (for two paddy crops) dry grain, viz., cholum, cumbu, yelloo or ragi are sown as the first crop and paddy as the second crop. In dry lands also there is rotation. In lands on which cholum, cumbu and other dry crops have been cultivated, black-gram, horse-gram, green-gram, Bengal-gram, and other quick-growing crops, which require only a small quantity of rain, are cultivated in rotation either before or after the principal crops."

The Collector of South Canara, Mr. W. M. Cadell, said :—

"The rotation of crops, as a rule, may be said to be unknown."

Mr. Ballard, Collector of Malabar, reported :—

"Nor is any rotation practised with the dry crops."

32. These statements are supported by a scrutiny of the cropping of the State arable lands which gives the following results :—

Area under	Acres.*	Percentage.
Cereal food-grains	17,966,000	76·28
Pulse crops	2,132,000	9·05
Indigo	259,000	1·10
Cotton and other special crops	1,447,000	6·14
Oil-seeds	1,306,000	5·54
Garden crops	444,000*	1·89
Total ...	23,554,000	100·00

These crops might be divided as follows, if they were properly managed, but in reality the comparison between the areas under "restorative" and "exhaustive" crops is worse than what is shown.

Area under	Acres.	Percentage.
Restorative crops	1,565,000	5·56
Waste, called fallow	4,625,000	16·41
Exhaustive crops	21,989,000	78·03
Total ...	28,179,000	100·00

Compare the state of things shown above with the cropping of Great Britain where there are—

Under	Acres.	Percentage.
Restorative crops	7,566,000	42·08
Fallow	616,000	3·43
Exhaustive crops	9,800,000	54·49
Total ...	17,982,000	100·00

But there are also in Great Britain 13,728,000 acres of permanent pasture, meadow, or grass not broken up in rotation (exclusive of heath or mountain land), an item to which nothing corresponding is to be found in this country.

FALLOWING.

33. As has already been observed there is no system of "Fallowing" prevalent; but there is annually a very large area of land (about 5 against 22 million acres cultivated) left waste by the ryots for longer or shorter periods; this land is entered as fallow in the agricultural statistics. During the time this land is not under crop, it receives no treatment whatever, being allowed to produce such herbage, weeds, or pasture as it naturally can. Besides this, about 1,000,000 acres of land are annually relinquished by the tenants, who surrender thereby all their claims to the land: generally speaking this land comes under cultivation again after a lapse of some years, being granted to applicants without any charge, except that of petitioning. The advantages of leaving land simply waste are very small, as then it is only by the unaided agency of natural forces that the inert stores of plant-food in it are rendered available for the crops which will be grown on the land afterwards; whereas, under

Lands get rest, but no special treatment.

* The figures given are those for 1874-75.

a rational system, fallowing aids in the disintegration of the soil, and by exposing it to the influence of the atmosphere adds greatly to its productive power for the time being.

34. There are good reasons for a belief that, at an early period in India, the land was cropped under a "three-field system;" that is, one part was being cropped; one portion producing inferior pasture; whilst a third portion was bare. It is evident, from the fact that the arable areas has been so greatly increased, that a larger proportion of each village area is now called upon to raise a crop; and it necessarily follows, that there must be a proportionally smaller area undergoing the restorating influence of "rest."

35. It may here be interesting to note the following figures:—

Area under	1858-59.	1875-76.	Increase or Decrease.	
	ACRES.	ACRES.	ACRES.	PERCENTAGE.
Cotton	1,042,000	1,445,000	+403,000	+ 38·7
Indigo	173,000	301,000	+128,000	+ 74
Sugarcane	38,000	33,000	— 5,000	— 13·2

Did the ryot use his crops as he should these figures might be said to be on the whole not unsatisfactory; but under existing circumstances they are not reassuring, and lead to the conclusion that the systems of cropping now pursued are more racking than formerly. Cotton is a most exhausting crop; indigo, although under rational management a renovating, is under ordinary native culture one of the most trying there is; sugarcane is a crop demanding heavy manuring and high culture, and a decrease of the area under it shows that there is less good agriculture in the country.

36. The growth of "fallow crops" is a thing unknown, that of renovating crops almost so, whereas in this country we possess admirably suited commonly grown plants for the latter purpose.

37. It is doubtful whether "bare fallows" will ever be an advantageous portion of the rotation in this country; as they must cause so great diminution of the organic constituents of the soil, to the conservation and increase of which every effort should be directed.

EXHAUSTION OF THE SOIL.

38. This is the natural sequence to the want of attention on the part of the ryot, either through ignorance or otherwise, to the laws of plant-life. It is however absurd to suppose that, except in the case of land newly brought under cultivation, or which has not been arable for more than a few years, a short personal experience could note any signs of greatly decreased productive power. When soils are reduced to a certain rate of production, it has been found that the time of their ultimate exhaustion will be deferred for a great length of time, owing to the supplies of plant-food in them, when it has been cropped successively for some years without manure, not existing in an immediately available form; these matters are in fact inert, and are only brought into a form in which they can be made use of very slowly; and by the amount annually rendered available for the nourishment of the crops is the productive power of the soil limited. It must be remembered that land may become exhausted for profitable culture under a bad system of husbandry, and be unfitted for ordinary farming, until a large expenditure has been incurred, but still may be able to afford such scanty returns as those with which many ryots are contented. Soils when

Difficulties of observing.

Reason for slowness of exhaustion.

reduced to such a starving condition feel the difference of seasons, good and bad, far more than those which are in a high state of fertility. These facts have been proved conclusively in England and elsewhere.

Results in other countries.

39. It will be accepted without argument that the results of continuous cropping without manure must be the same in all countries. This being the case, with the results which have followed such a system in South Australia, where the farmers have to content themselves with a product of 11 bushels of grain per acre; in the United States and in Canada, where the product per acre has been halved in twenty years; in some of the Western States indeed, where all the land now cultivated was twenty years ago prairie, the reduction on the first broken areas is even greater, the produce now being as low as that of South Australia. There are no reliable records available in this country to show that any deterioration of the soil has occurred in particular instances;

Want of data.

and even it is doubtful whether there has been any very large proportion of our arable lands regularly under cultivation without intermission for the last fifty years—probably only those of the first quality or which lie near towns and villages have been so. Regarding the irrigated lands, the present average rates of outturn are extremely low, probably from the worn-out state of the soil: water of itself, unless it contains, as it doubtless does in many cases, quantities of valuable plant-food in suspension or solution,

Low condition of our soils.

is only a stimulating and dissolving body: it, by means of the carbonic acid, oxygen, &c., it contains, acts on the inert portions of the soils and converts them into available plant-food; where this goes on without recuperative benefits, as is probably the case in canal irrigation, where, after long transport at a slow speed, the water is applied to the land, there must no doubt be an increase in the rate of exhaustion, which will lead to the land so treated becoming practically sterile—a result not without precedent; for there are tracts of country in Africa and Northern India, apparently exhausted by effects of irrigation without manure and abandoned.

Popular grounds for belief in exhaustion.

40. The popular belief in the exhaustion of the soil is very strong in Madras, and, being founded on a basis of scientific deduction and common sense, is gaining ground. It is supported by few facts of statistical nature, but the great truths of science are brought forward; and especial reference is always made to the unirrigated lands, garden and irrigated lands receiving in some measure a recompense for the crops removed from them. It is well known that the use of manure for unirrigated lands is confined to an extremely small area; it is also known that these lands are now often continuously cropped with cereal grains year after year, their only rest being an occasional year or so as "waste," by which means little benefit accrues; it is known that few renovating crops are grown; it is further known that the yield of grain per acre is extremely small; and it is also known that about 5* per cent. of the unirrigated lands under cultivation are annually relinquished because they will no longer produce remunerative crops. It is also known that the area annually relinquished increased during the fifteen† years ending July 1872 by about 75 per cent., showing that the lands under cultivation cannot now so long support the racking system of cropping pursued by the ryots.

Poverty of our best soils.

41. It may also be safely asserted that even the best soils in the country—those devoted to the growth of tobacco—are very poor in at least one essential element of plant-food; namely, potash. Mr. Broughton found, in the ash of the tobacco produced in the following districts, the percentages of potassium carbonate mentioned below; the average amount of this substance in several foreign tobaccos is given for the sake of comparison:—

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* Unirrigated lands cropped per annum ... ... 16,232,000 Acres.
Do. relinquished do. ... ... 751,000 „
† Average total area relinquished in the five years ending June 1876 ... 1,097,103 „
Do. do. do. do. 1864 ... 626,238 „
Do. increase of area annually relinquished ... ... 470,865 „

	Per cent.
Trichinopoly	6·01
Cuddapah	4·39
North Arcot	4·58
Coimbatore	7·68
Kistna	13·52
Madura	7·02
Maryland	40·47
Massachusetts	47
Hungarian	26·46
Wurtemberg	27·4

The best result, given with Madras tobacco, is with that grown on the alluvial islands of the Kistna District, where the soil is always being added to and changed by the silt brought down by the rivers. If the very best and most highly manured soils give such unmistakeable evidence of poverty in such an important substance as potash, what must be the condition of the ordinary arable soils, which have not from the day they were first broken up received a particle of manure designedly?

Small produce per acre.

42. The following quotation, from a report of Mr. Robertson's, is strikingly illustrative of the state of the soils of the country:—

"The yield of the soils is also worth considering; thus, while in Madras, the ryot is contented to get 70 or 80 pounds of clean cotton per acre, the American farmer is not contented unless he gets from 450 to 500 pounds per acre. The same with rice; an average crop of paddy in this Presidency is about 15 bushels per acre; in America, 70 bushels is no unusual crop. In Madras a maize crop of 10 bushels per acre is a good one; in America crops of this grain vary from 50 to 80 bushels, and sometimes even amount to 100 bushels per acre."

Low value of Indian produce.

43. In conclusion I would mention another point which is worthy of attention; it is the low value attached to almost all the exported products of the country. Why should not as good arrow-root, tamarinds, ginger, sugarcane, indigo or tobacco be grown in India as in the West Indies? Why should Indian cotton be of so much less value than the American product? Why is India not capable of producing a wool of at least the value of that grown in Queensland? Why will not Carolina paddy flourish under Hindu farming? Why are the hides of our cattle of so little value compared with those from North and South America? Why cannot hemp be grown of equal value to that produced in other countries? The answer to most of these questions is that Indian agriculture is so backward and Indian soils are so poor, that Indian ryots are unable to grow almost everything of an improved description. That Indian products are of so low a comparative value a reference to any London prices current statement will show.

Exhaustion, natural result of Indian farming.

44. In fact it is not within the capacity of the imagination for any one, knowing the facts of the case, to believe that our arable soils are not in a most exhausted state. This being the case and it being clear that the cause of such a state of things lies in the defective agricultural practices of the country, should not every effort be made to diffuse throughout the length and breadth of the land such a knowledge of the principles, which guide and govern the operations of husbandry when conducted in a rational manner, as will of itself lead to the abandonment of those practices which are most hurtful to the State and unwise on the part of the cultivator?

(Signed) CHARLES BENSON, M.R.A.C.,
Superintendent of Saidapet Farm.

SAIDAPET,
November 14th, 1878.

AGRICULTURAL EDUCATION IN GERMANY AND AUSTRIA.

1. Soon after Lavoisier had first startled the world with his discoveries, the enquiring men of the age began to vie with each other in their endeavours to render the triumphs of science serviceable to man. Amongst the first that applied scientific principles to Agriculture was Thaer, in Germany. As an agricultural writer Thaer, although many of his theories have been superseded by others resulting from more recent research, still holds a foremost place. But he did not content himself with expounding theories; his first care was to demonstrate their bearing on the practice of the farmer.

2. At Celle, his native town, he established the first Agricultural School in Germany, and became thus the founder of a new agricultural era, well deserving the name "father of modern agriculture" by which he is known in that country. The results of his institution were so favorable that it was soon afterwards decided to establish an agricultural school, on a large scale, in Moglin in Prussia, in the year 1804. From that time the number of agricultural schools has increased regularly; and especially during the last fifteen years, so many schools have sprung up that at present, the whole country is covered with them, thereby making agricultural education accessable to every one.

3. Agricultural Schools in Germany may be divided into three classes: High-schools, Middle-schools and Lower-schools.

4. The High-schools, being State institutions are under the general control of the Ministers of Agriculture where one exists, or that of the Minister of Education. They are supported by State funds, and their officers are Government Servants, being appointed by the minister under whose control the institution may be. All expenditure must be first approved by the minister, and all charges in the organization of the school and the number of lectures to be delivered must first be sanctioned by him. The final examination is supervised by the minister, who deligates a special officer to attend it, and to countersign the diplomas of each graduate. The Middle-schools generally called, Ackerban Schulen or District schools, being the property of the district are mostly under the management of the district authorities they are partly maintained by district funds, and partly by the State. The Lower-schools are generally managed by the district authorities, by local authorities or by agricultural societies, but must conform to certain rules laid down by Government. They are subsidized by district funds, by funds provided by communities, societies and private persons.

5. The High-schools several of which form branch of the Universities afford instruction in all the sciences pertaining to agriculture, in the highest degree. The course of study lasts, generally two years and is entirely devoted to theoretical teaching in the Lecture-room and to practical demonstrations in the Laboratories, Museum, Botanical and Experimental grounds, &c. Generally before entering the high school, the student must have undergone a practical training for two years on a large farm, or must have passed the standard of a lower grade school; out-of-

door labor is therefore not encouraged at these institutions, the time of the student being fully occupied with study.

6. Whereas the chief object of the High-schools is the study of the sciences pertaining to agriculture, that of the Middle-schools is practical training. The summer months are, rainy days excepted, mostly devoted to field work and the winter months to work in the class rooms. Much of the time is devoted to general education. These schools are intended to fit the student to manage rationally a small farm, to become a subordinate agent of a large farm, or prepare him for the High-school. These schools have a regular staff of professors and teachers, which is sometimes very large. They are not of uniform grade; some of them are nearly allied to the high schools, others again more to the lower schools.

7. The lower schools are of various grades according to the funds available, and the requirements of the district in which they are located. The course of instruction in some of them extends over two Winter Sessions; during the summer months, the students being allowed to go to their homes to assist their parents in the cultivation of their farms. These schools afford a complete elementary agricultural education. For conducting these schools a regular staff of teachers is appointed, the members of which are besides employed as agricultural engineers, agricultural itinerant teachers, secretaries of agricultural societies, &c. Such schools are nearly allied to the Middle-schools. Other schools of this class have no regular staff of agricultural teachers; the veterinarians, forest officers, engineers and provincial Farmers of the district being temporarily appointed to lecture as occasion arises. Again in others, the most primitive instruction only, is given, and this by the schoolmaster of the place, at evening hours, or, on Sundays. The schoolmasters usually have received some agricultural training. Very often the lower schools instruct only in that branch of agriculture which is chiefly carried on in the district; so that in a district where the culture of the vine is predominant, the chief aim of the school is to train its pupils in the culture of the vine, in others the pupils are instructed in the culture of tobacco, or flax, in others only instruction is given in Horticulture; but these technical schools are usually attached to a higher grade school. The High and Middle-schools are in most cases liberally endowed, but for the lower schools there is seldom a regular fund for the purpose. The State often grants a certain sum to the agricultural societies for distribution. The greater number of these lower schools have only recently been established and are yet only partially organised.

8. High schools exist at the following places (Bavaria is not included, but will be referred to separately);—

1 Berlin,* 2 Eldena, 3 Giesen,* 4 Gottingen,* 5 Halle,* 6 Heidelberg,* 7 Hohenheime, 8 Jena, Kiel,* 9 Koeingsberg,* 10 Leipsig,* 11 Poppelsdorf,* 12 Proskau, 13 Worms.

9. Besides these, there is at nearly every University where the agricultural school forms not a branch of the institution, a chair of agriculture. Forest and Veterinary schools of which there are several in Germany are not included.

* The agricultural school is a branch of the University.

The following Table shows the Number of Agricultural Schools in Bavaria during the Year 1872 *with their Attendance, Income and Expenditure. The figures are taken from the Statistical Report on Education, in Bavaria, for the Year* 1872.

	Agricultural Schools.*	Number of Schools.	Duration of Study and Years.	Number of Professors and Teachers.	Number of Students.	Income from					Total Income.	Total Expenditure.	
						School Fees.	State.	District.	School Farm.	Diverse Sources.			
						Florins.	Florins.	Florins.	Florins.	Florins.	Florins.	Florins.	
High-schools.	Royal Central School of Agriculture, Weihenstephen.	1	2	21	131	15,240	17,000	...	21,743	97	54,080	51,421	...
	Royal Central Forest School at Aschafferburg.	1	3	8	135	2,650	23,191	...	...	321	26,170	26,170	...
	Royal Central Veterinary School at Munich.	1	...	...	...	...	25,632	...	...	6,930	32,562	32,562	...
	Middle-schools	7	2	55	221	22,612	1,200	35,327	7,771	4,252	71,172	69,027	1,79,180
	Lower-schools	932	...	...	18,146	...	Not known.		...	...	...	...	...

* Besides the institutions mentioned in the list Agricultural lectures are given by the Professors at the University of Munich.

10. The following list shows the subjects on which lectures are given at the Royal Bavarian Central School of Agriculture, Weihenstephan, taken from its annual report ending July 1878 :—

Subjects.	First Year's Course.		Second Year's Course.	
	Winter Session.	Summer Session.	Winter Session.	Summer Session.
	Hours per Week devoted to subject.			
Mathematics	5	...	...	...
Physics	3	...	...	...
Chemistry	4	5	...	1
Natural Science	4	3	...	...
Anatomy of Plants	...	3	...	...
Anatomy and Physiology of Animals	6	...	...	...
Physiology and Pathology of Plants	...	...	...	2
Knowledge of Soils	...	3	...	...
Agricultural Engineering	...	...	...	2
Plant culture	...	...	5	2
Culture of fruit trees	...	...	1	...
Breeding of agricultural stock	...	3	4	2
Exterior do.	...	...	...	2
Veterinary	...	...	...	1
Technology	...	...	4	2
Applied Mechanics	...	...	2	...
Tools and Machines	4	...	...	...
Agricultural buildings	...	2	1	1
Do. Law	...	...	2	2
Book-keeping, double entry	1	...	1	...
Management of Brewery	..	1	...	...
Political Economy	...	...	3	...
Rural Economy	...	...	1	2
Forestry	...	...	2	2
Agricultural taxation	...	...	...	2
Cambistry	...	...	1	...
Banking	...	...	1	...
History	1	1	1	1
Literature	1	1	1	1
Chemical laboratory	...	4	...	2
Technical laboratory	...	...	4	...
Microscopical laboratory	...	2	...	...
Botanic excursion	...	2	...	...
Plant culture excursion	...	...	...	2
Fruit Tree culture excursion	...	...	...	2
Forestry do.	...	...	...	2
Surveying and Levelling	...	4	2	...
Drawing	4	...	2	...
Total	33	34	36	33

11. The staff of lecturers consisted of 22 professors and teachers, the number of students was 129.

12. The following list shows the subjects taught at the Agricultural Middle School (Ackerbanschule) in Schleissheim near Munich which will convey an idea of the work of the schools generally :—

	Hour per Week.
German Language	1
Arithmetic	1
Physics	1
Chemistry	1
Technology	1
Tools and machines	1
Geometry	1
Surveying and Levelling	1
Drawing	1
Horticulture	1
Forestry	1
Veterinary	1
Management of meadows and drainage	1
Plant culture	1
Breeding of Agricultural stock	1
Soils	1
Manures	1
Management of Farm	1
Zoology	1
Botany	1
Gymnastics	1
Fire Brigade Exercise	1

The following Table shows the Number of Schools of Agriculture and Forestry existing in Austria on the 31st March 1877 (Hungary not included) taken from the Report of the Minister of Agriculture of Austria for the Year ending 31st March 1877.

Year of Establishment.	Name of the Schools.	Number of Schools. State.	District.	Community.	Society.	Private.	Duration of Study in Years.	Combined with Pensionate.	Number of Professors or Teachers.	Frequents during the Year 1876-77.	Number of Graduates.	Expenditure of the Year exclusive of Stipends. Ordinary Expenditure.	Lecture Fees.	Income for the Year. From State.	From Districts.
	I.—High Schools of Agriculture and Forestry.											Florins.	Florins.	Florins.	Florins.
1872	K. K. High Agricultural School, Viena.	1	...	...	...	...	3	...	42	224	41[2]	112,650[3]	61,850[13]	112,650[6]	...
	Shown last year ...	1	...	...	...	...	...	...	29	167	18	117,400	62,712	117,400	...
	II.—Middle Schools.														
	(a.) *Agriculture.*														
1869	Modling	...	...	...	1	...	3	...	10	94	20	29,312[4]	15,848[4]	11,000[5]	...
1850	Tetschen, Lichwerd	...	1	...	...	...	3	1	15	81	26	26,482	11,250	3,000	17,664
1866	Tahor	...	1	...	...	...	3	...	12	68	44	18,000	13,000	3,000	15,000
1875	Neutitschein	...	1	...	...	...	3	...	6	24	...	10,600	5,880	5,000	5,600
1875	Preran	...	1	...	...	...	3	...	6	19	...	9,780	5,630	5,000	4,780
1869	Ober-Hermsdorf	...	1	...	...	...	3	1	8	50	13	9,728	5,800	5,000	6,200
1855	Dublany	...	1	...	...	...	3	1	*11	*50	*10	*17,328	*11,055	5,500	*12,000
1871	Czernowitz	...	1	...	...	...	3	...	7	18	1	*6,000	*5,150	500[6]	*3,500
	Total ...	...	7	...	1	...	...	3	75	404	114	127,230	73,613	38,000	64,744
	Shown last year ...	...	7	...	1	1	...	4	79	415	115	152,199	83,277	37,000	71,700
	(b.) *Forestry.*														
1852	Eulenberg	...	...	...	1	...	2	1	5	43	20	11,291	6,256	...	2,400
1855	Weisswasser	...	...	...	1	...	2	...	5	82	*21	10,755	8,548	...	...
1874	Lemberg	...	1	...	...	...	2	...	9	35	10	10,800	*7,800	5,000	*5,800
	Total ...	...	1	...	2	...	...	1	19	160	51	32,846	22,604	5,000	8,200
	Shown last year ...	...	1	...	2	...	...	1	19	161	41	31,787	21,489	5,000	8,200
	(c.) *Horticulture.*														
1874	Klosterneuburg	1	...	...	...	...	3	...	9	38	8	22,800[8]	13,300[8]	22,800[6]	...
	Shown last year ...	1	...	...	...	...	...	...	11	46	...	20,425	15,615	20,425	...
	Total of Middle Schools ...	1	8	...	3	...	...	4	103	602	173	182,876	109,517	65,800	72,944
	Shown last year ...	1	8	...	3	1	...	5	109	622	156	204,411	120,381	62,425	79,900
	Lower Schools of Agriculture and Forestry.														
	(a.) *Agriculture.*														
1872	Edthof at Amstetten	...	1	...	...	...	1	1	5	10	10	*8,000	*3,050	...	*8,000
1873	Edelof at Zwettl	...	1	...	...	...	1	1	4	16	16	9,394	3,900	...	9,394
1873	Feldsberg	...	1	...	...	...	2	1	9	37	21	9,567	3,846	1,200[1]	6,000
1864	Ritzlhof	...	1	...	...	...	2	1	3	23	8	8,020	3,300	1,500	6,520[2]
1874	San Michele	...	1	...	...	...	2	1	9	36	11	9,980	6,000	4,000	5,980[3]
1872	Rovereto	...	...	...	1	...	3	1	*8	*31	*5	*7,930	*2,580	2,500	...
1873	Trient	...	...	...	1	...	3	1	6	27	*16	9,246	2,000	2,500	...
1867	Grottenhof	...	1	...	...	...	3	1	3	31	5	6,800	3,060	...*	6,800
1866	Klagenfurt	...	...	...	1	...	2	...	8	33	8	5,000	2,500	2,000[5]	2,000
1869	Gorz	...	1	...	...	...	2	1	6	22	6	8,596	7,900	3,000[6]	5,596
1863	Chrudim	...	...	1	...	...	2	...	8	56	21	7,600	4,100	1,000	4,000
1864	Hracholusk	...	...	...	1	...	2	1	9	32	26	*6,900	*3,970	1,000	4,000
1862	Kaaden	...	...	...	1	...	2	...	5	54	25	6,858	3,683	1,000	4,000
1872	Klattan	...	...	...	1	...	2	1	5	11	7	3,400	2,500	1,500	1,500
1868	Libejie Rabin	...	...	...	...	1	3	1	6	20	8	*2,280	*1,375	...	...*
1850	Liebwerd	...	...	...	1	...	2	1	8	25	11	3,150	*2,113	...	*3,150
1870	Pisek	...	...	...	1	...	2	...	13	17	4	4,409	1,900	1,000	1,000
1865	Rakonitz	...	...	1	...	...	2	...	1	9	...	800	720	...	...
1866	Eibenschitz	...	...	...	1	...	2	...	7	8	5	6,142	3,910	2,000	3,500

* Taken from last year's report.

The following Table shows the Number of Schools of Agriculture and Forestry existing in Austria on the 31st March 1877 (Hungary not included) taken from the Report of the Minister of Agriculture of Austria for the Year ending 31st March 1877—(Continued).

Year of Establishment.	Name of the Schools.	Number of Schools. State.	District.	Community.	Society.	Private.	Duration of Study in Years.	Combined with Pensionate.	Number of Professors or Teachers.	Frequents during the Year 1876-77.	Number of Graduates.	Expenditure of the Year exclusive of Stipends. Ordinary Expenditure.	Lecture Fees.	Income for the Year. From State.	From Districts.
	LOW SCHOOLS OF AGRICULTURE AND FORESTRY—(*Continued*).											Florins.	Florins.	Florins.	Florins.
	(*a.*) *Agriculture*—(Continued).														
1865	Kloster Hradisch	...	...	...	1	...	2	1	6	20	...	3,680[8]	2,580	...	...
1875	Kremsier	...	...	...	1	...	1	...	2	13	26	1,450	1,000	...	...
1867	Mahr-Schonberg	...	...	...	1	...	2	1	6	36	9	8,342	3,866	2,000	3,500
1867	Meseritsch, Gross	...	...	...	1	...	2	...	7	21	10	5,765	4,136	2,000	3,500
1868	Znaim	...	...	...	1	...	2	...	8	35	15*	*5,948	*2,520	2,000	3,500
1872	Kotzoben	...	1	...	...	...	2	1	6	39	11	11,114	4,911	4,000	4,000
1860	Czernichow	...	...	...	1	...	3	1	10	36	7	10,450	7,529	2,000	7,000
1872	Dublany	...	1	...	...	...	2	1	4	12	6	2,400	1,800	1,500	...
	Total	...	9	2	15	1	...	18	172	710	297	173,221	90,750	37,700	92,940
	Shown last year	...	8	2	15	1	...	18	172	719	240	166,473	81,974	39,620	105,330
	(*b.*) *Forestry.*														
1875	Aggsbach	...	...	...	1	...	1	1	2	19	16	2,270	1,550	300	300
1877	Bregeuz	...	1	...	...	...	$\frac{1}{10}$	...	1	13	...	450	2	200	250
1874	Wildalpen	...	...	...	1	...	2	1	4	9	...	2,770	800	...	...
	Total	...	1	...	2	...	...	2	7	41	16	5,490	2,350	500	550
	Shown last year	...	...	...	2	...	...	2	6	24	6	5,087	2,345	300	...
	(*c.*) *Lower Schools for Horticulture Fruit and Vine Culture.*														
1868	Viena	...	...	...	1	...	$\frac{1}{2}$	...	6	9	8	1,326	1,080	1,200	...
1870	Modling	...	...	...	1	...	2	1	7[1]	13	8	...[1]	...[1]	...	...
1875	Krems	...	1	...	...	...	1	...	3	11	8	4,533	2,091	...	4,533
1872	Efferding	...	...	...	1	...	$\frac{1}{2}$	...	1	5	...	200	50	200	...
1872	Bozen	...	...	...	1	...	1	...	1	5	4	2,470	1,500[3]	1,500	...
1871	Wienberlhof	...	...	...	...	1	$\frac{1}{2}$ & $\frac{1}{2}$	1	1	4	3	500	...	...	...
1872	Marburg	...	1	...	...	...	3	1	6	41	13	9,071	4,047	...	9,071
1875	Marburg	...	1	...	...	...	...	...	1	68	...	1,916	1,500	1,200[4]	716
1872	Graz	...	...	...	...	1	12u	1	3	9	2	7,486[1]	1,650	600	...
1872	Klagenfurt	...	...	...	1	...	3	...	7	14	2	600	450	500	...
1873	Slap	...	1	...	...	...	2	1	3	9	1	6,669	2,310	2,000	4,669
1874	Gorz	...	...	...	1	...	...	...	2	60	...	...	...	...	...
1856	Prag	...	...	...	1	...	1	...	1	25	*18	...	...	...	...
1871	Troja	...	1	...	...	...	$\frac{1}{3}$u 1	1	3	15	19	11,084	2,400	3,000	8,084
1863	Brunn	...	...	...	1	...	1	1	1	7	7	700	...	...	500
1856	Brunn	...	...	...	1	...	1	...	2	36	14	...	...	...	...
1870	Ober, Hermsdorf	...	1	...	...	...	1	1	2	7	5	7	...	...	...
1870	Czerinchow	...	...	...	1	...	2	1	4	8	6	1,009[3]	499	2,000	...
1855	Lemberg	1	...	...	...	...	4	1	5	9	...	510	510	510[9]	...
1872	Lemberg	...	...	...	1	...	2	1	3	10	2	623[10]	399	771	...
	Total	1	6	...	11	2	...	11	62	365	120	48,697	18,486	13,481	27,573
	Shown last year	1	6	...	12	2	...	11	70	382	127	75,650	18,447	14,670	38,604

* Taken from last year's report.

The following Table shows the Number of Schools of Agriculture and Forestry existing in Austria on the 31st March 1877 (Hungary not included) taken from the Report of the Minister of Agriculture of Austria for the Year ending 31st March 1877—(Continued).

Year of Establishment.	Name of the Schools.	Number of Schools. State.	District.	Community.	Society.	Private.	Duration of Study in Years.	Combined with Pensionate.	Number of Professors or Teachers.	Frequents during the Year 1876-77.	Number of Graduates.	Expenditure for the year exclusive of stipends. Ordinary Expenditure.	Lecture Fees.	Income for the Year. From State.	From District.
	(d.) Schools for Brewery and Distillery.											Florins.	Florins.	Florins.	Florins.
1870	Modling	...	...	...	1	...	1½	...	8[1]	30	28	...[1]	...[1]	...	...
1868	Prag	...	...	...	1	...	[illegible]	...	*10	*44	*38	2,759	*2,295	...	...
1875	Litten	...	...	...	1	...	⅓	...	4	14	11	1,200	*880	200	200
1870	Lemberg	...	...	...	...	1	⅓	1[2]	6	21	14	1,921	1,296	800	... *
	Total	...	...	...	3	1	...	1	28	109	91	5,880	4,471	1,000	200
	Shown last year	...	1	...	3	1	...	2	30	112	91	5,431	4,223	1,100	...
	(e.) Culture of Flax.														
1875	Schonberg	...	...	...	1	...	¼	...	2	9[3]	*3	...	...	...	...
1870	Grodeck	...	...	...	1	...	⅚	1	2	11	4	2,944	1,508	3,000	...
	Total	...	...	...	2	...	...	1	4	20	7	2,944	1,508	3,000	...
	Shown last year	...	...	...	2	...	...	1	4	9	3	3,125	1,025	3,000	...
1869	Gorz	1	...	...	...	...	1/10	...	2	33	20	...[4]	..[4]	...[4]	...
	Total of *c. d. e.*	2	6	...	16	3	...	13	96	527	238	57,521	24,465	17,481	27,783
	Shown last year	1	7	...	17	3	...	14	104	503	221	84,206	23,695	18,770	38,604
	Total of Low Schools	2	16	2	33	4	...	33	275	1,278	551	236,232	117,565	55,681	121,263
	Shown last year	1	15	2	34	4	...	34	282	1,246	467	255,766	108,014	58,690	143,934
	RECAPITULATION.														
	High School	1	...	...	...	...	...	...	42	224	41	112,650	61,850	112,650	...
	Middle Schools	1	8	...	3	...	...	4	103	602	173	182,876	109,517	65,800	72,944
	Low Schools	2	16	2	33	4	...	33	275	1,278	551	236,232	117,565	55,681	121,263
	Grand total of all Schools of Agriculture and Forestry on the 31st of March 1877	4	24	2	36	4	...	37	...	2,104	765	531,758	288,932	234,131	194,207
	Shown last year	3	23	2	37	5	...	39	...	2,035	641	577,577	291,107	238,515	223,834

* Taken from last year's report.

K. SCHIFFMAYER,
Asst. Supt., Government Farms.

EXPERIMENTS IN WET CULTIVATION.

1. In Sooprayapooram, a village attached to the Maganum Tirounellaur, 3 miles from Karrikal I made the following experiments induced to do so by the study of Mr. Robertson's reports.

2. *Plot No I* containing ·76 acre is a sandy soil. During dry season no cracks are apparent on the surface.

3. *Plot No. II* is sandy on the surface and shows no cracks during the dry season ; but the subsoil is quite clayey. They call it Oolei kilar. Even during the dry season, when the surface is firm there are unsound clay places below in which cattle would sink to the knee. These they always avoided and would pass only when forced. It contains 1·92 acres.

4. *Plot No. III* is a stiff clay, during the dry season is full of deep cracks, containing ·66 acres or 2 mahs. When blocks of this stiff clay were turned, they contained plastic clay containing moisture, whereas on the surface and bottom it was dry earth.

5. In 1875 I bought an English plough called Howard's combined plough, and as it was in pieces nobody at Negapatam knew how to fit it together (though we could form some idea of it from seeing a figure of it in the Agricultural class-book) till a brother of the Society of Jesus in St. Joseph's College set it all right very soon. I must say that this was one of the ploughs supplied by the Madras Government some years back and three Mirasdurs bought it to please the taluk authorities and it was never used by them, but was lying idle at Negapatam where I managed to get it.

6. Soon after harvest in the middle of February 1875 and before the commencement of the dry season, the three plots were ploughed up to the depth of 6 inches by the said combined plough. Buffalo bulls, such as are used in drawing carts, were yoked and pulled the plough with ease. All the three plots were ploughed twice.

7. To Plot No. I, twenty-five cart loads of ashes and street sweepings were applied towards the close of May or the beginning of June.

8. To Plot No. II, twenty carts of the said manure and forty carts of tank scourings (at eight cart loads for a rupee) were applied.

9. Plot No. III had no manure.

10. Plots Nos. I and II were grown with Arupatham Kuruvay paddy and Plot No. III with Segappu Serumany paddy well suited for seasons of drought. Though the former paddy is called Arupatham Kuruvay (60 day kuruvay) it actually takes almost three months to mature. It was sown in the month of June which is generally the commencement of the cultivating season in that part of the country. As soon as water was let in, country ploughs were used for puddling, and within three days the plants were transplanted. The Kuruvay seedlings were from eighteen to twenty-two days old. The Kuruvay plants were watered as country paddy plants.

11. Plot No. I yielded 33 kalams or 2,772 lbs. of Kuruvay paddy, and Plot No. II gave 48 kalams or 4,032 lbs. for the first crop. After the Kuruvay harvest I applied two cart loads of Kavaley poondu *Galega*, linnæus in Plot No. I only. This

plant is used as manure in many villages about Karrikal and grows in sandy soils near the coast. (I don't know if it is the wild indigo referred to by Mr. Robertson.) I have not seen this plant in the interior. After cultivating with country ploughs I again raised Chumba paddy in Plots Nos. I and II.

12. Plot No. I gave me 30 kalams or 2,520 lbs. and Plot No. II gave 35 kalams or 2,940 lbs. and Plot No. III gave 18 kalams or 1,512 lbs. but only one crop was raised on it.

13. In the next year which was one of general drought Plot No. I alone was grown with double crops as before. This year Plot No. I had no ash manure. About only five carts of cowdung were applied and about 50 sheep were folded in the said plot for about twenty days, these manure being ploughed in. The said plot, No. I, for double crops of Kuruvay and Chumba paddy, gave (60) sixty kalams or 5,040 lbs. Plot No. II had no double crop, as about the time of transplanting Kuruvay seedlings, the irrigating channel was dry. Of course Plot No. III had never double crops and it yielded very much the same as before, *viz.*, 18 kalams or 1,512 lbs. This plot was too low and generally inundated. It is also situated amidst the fields of Kallundai paddy which is suited for lands of low level, and the plot was not manured.

14. In this year especially which was one of general drought, the benefit of deep ploughing was very striking. For when the adjoining fields had suffered from Surey or Kulichombu my cultivation did not suffer. The deep-ploughed soils retained moisture till water came in, while other lands, not so ploughed, suffered.

15. In the third year the same thing was done as in the year preceding and Plot No. I of 2 mahs and 30 gulies or ·76 acres never yielded less than 60 kalams for 2 crops and ranged from 60 to 63 kalams or from 5,040 to 5,292 lbs. after paying the charges of reaping and threshing, whereas before the experiment the said plot scarcely yielded (10) ten kalams or 840 lbs. The results of the other plots are also satisfactory in that, while the average produce of these plots as well as of similar plots in the village under the ordinary system, was about 100 kalams or, 8,400 lbs. a Veli or 1,273 lbs. per acre, the produce under this experimental system was more than double that quantity. (I am sorry the exact quantity of produce under the old system for the same plots was not recorded before).

The inferences to be drawn from this are—

(1.) The excellence of deep ploughing cannot be doubted for one moment. The mere driving through the soil is incomplete, and it must be turned by deep ploughing.

(2.) That ploughing when the soil is dry soon after harvest is conducive to its enrichment as it lets the air, light, and rain reach the soil.

(3.) The plants in deep-ploughed lands withstand drought better than in surface cultivated soils and that plants in the former are free from diseases which attack the latter during drought.

(4.) That at the rate of yield of Plot No. I containing 2 mahs and 30 gulies or ·76 acres, which ranged from 60 to 63 kalams or from 5,040 to 5,292 lbs. for two crops, 1 veli or 6·6 acres of land can be rendered fit to yield more than 540 kalams or 54,360 lbs., or at the rate of 8,236 lbs. per acre when scarcely 8,400 lbs. a veli or 1,273 lbs. per acre is the average of the produce of similar lands in the said village.

(Signed) P. SAVARAYA PILLAY.

Mode of reducing Kalams to lbs. (Imperial weight.)

1 tolah	$= \frac{5}{1\frac{1}{2}}$ oz.
1 Madras measure	$= \frac{1}{2}$ marakal = 56 oz. = $3\frac{1}{2}$ lbs.
1 lb.	$= 38\frac{1}{2}$ or 39 tolahs (in round numbers) or $\frac{32}{80}$ Government seers or nearly $\frac{1}{2}$ seer.
1 kalam	= 84 lbs.

Mode of reducing Veli, Mah, Gulies to Imperial measure.

1 kole or rod	= 12 English feet.		
1 rod square	= guly or gunta	= 144 square feet.	
100 gulies	= 1 mah	= 14,400 square feet.	
		= $\frac{1}{4}$ cawni.	
20 mahs	= 288,000 square feet	= 1 veli.	
	= 6·6157 acres	= 5 cawnies.	

Communicated to the Superintendent of Government Farms.

(Signed) H. J. STOKES,
Ag. Collector of Tanjore.

(True Copy.)

(Signed) W. R. ROBERTSON,
Superintendent, Government Farms.

TOBACCO AND ITS CULTURE.

GENERAL.

History.—Tobacco became first known to Europeans at the close of the 15th century. It is said that the Spanish monk, Romano Pano, who accompanied Columbus to the New World, reported that the natives of St. Domingo rolled up the leaves of a plant, called there Guioja or Cohoba, and smoked them in pipes called Tobacco. More accurate accounts of the existence and the use of tobacco in St. Domingo were given by Hernandez de Oviedo in the year 1535, who especially pointed out that the plant was highly esteemed for its remedial virtues in many maladies. It is reported that a merchant brought the plant soon afterwards from Florida to Portugal, and that the same was cultivated in the Royal Gardens at Lisbon in the year 1558. Jean Nicot, French Ambassador at that court, having cultivated tobacco in his garden in the year 1560, and effected some remarkable cures with the leaves of this plant on some persons of his establishment, transmitted some seed to France, where the plant, on account of the great remedial virtues attributed to it, was so much favored that it was patronized by the Queen, and called *herbe de la reine, herbe sancta, herbe panacca, herbe de l'ambassadeur, &c.*, names which all died away gradually and gave way to the one adopted and retained in honor of the man by whom the plant was made generally known to Europe. Nicot and Nicotiana is the scientific name applied to tobacco, and was first adopted by Dalechamp in his work "Historia plantarum" in the year 1586.

Discovery, and introduction into Europe.

2. Hernandez de Tolèdo, who was commissioned by Philipp II to visit Mexico in the year 1560 to report on the natural productions of that country, most probably brought the first tobacco to Spain. To England tobacco was brought from Virginia by Captain Ralph Lane in the year 1586. To India the plant was brought, most probably, by the Portuguese at the commencement of the seventeenth century. It is sometimes asserted that tobacco is a native of India or China, but there is no substantial proof to support the allegation. From France the cultivation and use of tobacco rapidly spread, in spite of its prohibition by Government and the Clergy, over Italy and Eastern and Northern Europe.

Introduction into India.

3. Although tobacco has lost its fame as an universal remedial agent in sickness, it still holds a high reputation amongst medicinal plants. Its chief use, however, is as an article of luxury. The consumption of tobacco increases every year. To satisfy this demand, the production of this plant assumes annually larger dimensions; it has become a staple product of several countries; whole nations find in the cultivation, manufacture and trade of this article, the means of their support, the source of their affluence and wealth. In many countries the revenue is chiefly derived from tobacco; prohibitive laws have made room for decrees encouraging and facilitating the production and manufacture of this commodity; agents are appointed to instruct the cultivator, how to raise the best plants, and how to produce the heaviest crops; schools have been founded to initiate the rising generation into the art of treating the leaf after its production. Everywhere it is recognised, that, in the development of tobacco-cultivation, there lies a source of wealth expanding in proportion as intelligence guides the undertaking.

Value of the product.

BOTANICAL CLASSIFICATION.

4. Tobacco (*Nicotiana*) (Tam.) pogheieley; (Tel.) poghaku; (Hind.) tumbaku; belongs to the natural order Solanaceæ, a very extensive order, including some of the most virulently poisonous plants known, as also some of our common vegetables, as the potatoe and brinjal, nearly all the members of this order contain in some form narcotic and poisonous qualities.

Natural order.

5. The general characters of the tobacco plant are the following:—

General characteristics.

The calyx, consisting of 5 united sepals, is urceolate and persistent; the corolla, composed of 5 petals, is united, the tube of the corolla being much longer than the calyx. There are 5 stamens. The ovary is provided with a long style, the stygma of which is emarginated. The capsule, possessing from 2 to 4, seed-vessels, opens by rupturing at the apex.

6. Many species of tobacco exist: The chief and most important to the cultivator are the following:—

I. NICOTIANA MACROPHYLLA.—Synonyms:—N. latifolia, N. lattissima, N. gigantea, Maryland tobacco. *Root*, white fibrous and ramified. *Stem*, 4 to 8 feet high, cylindric, velveded and much branched. *Leaves*, usually ovate, sub-ovate, or cordate and thin ribbed, the nerves branching off from the mid-rib nearly at right angles. *Flower*, reddish, purple and paniculate; mouth of corolla inflated.

1. Sub-species—*Stalkless Maryland tobacco.*

(*a.*) *N. Macrophylla ovata.*—Short leafed Maryland tobacco. *Leaves*, egg-shaped, auriculated at their base, and clasping the stem, 1½ times as long as broad. Produces a good smoking tobacco.

(*b.*) *N. Macrophylla longifolia.*—Long-leafed Maryland tobacco. Length of leaves about three times their breadth, clasping the stem and standing close together. This variety produces a good smoking tobacco, and excellent wrappers for cigars.

(*c.*) *N. Macrophylla pandurata.*—Broad-leafed or Amersfort tobacco. Leaves oblong, very large, thick, smooth and gummy. This variety, which is much cultivated in Holland and Germany, produces heavily and is especially adapted for the manufacture of good snuff.

2. Sub-species—*Stalked Maryland tobacco.*

(*a.*) *N. Macrophylla alata.*—The stalks of this variety are winged and auriculated at their base.

(*b.*) *N. Macrophylla cordata.*—Heart-shaped Maryland tobacco. Leaves heart-shaped with short naked stalks. This variety produces a very fine leaf; the fine Turkish leaves being probably the produce of it.

II. NICOTIANA AUGUSTIFOLIA.—Virginian tobacco. *Leaves* hanging downwards, mostly lancet-shaped and very thick. Nerves branching from the mid-rib at an acute angle. *Corolla* elongated, the upper portion bell-shaped, the segments long and pointed. Flowers pink-colored, cymose, or paniculated.

1. Sub-species—*Stalkless Virginian tobacco.*

(*a.*) *N. Augustifolia acuminata.*—Leaves grow nearly horizontal, six times as long as broad, pointed, lanceolate and decurrent. This variety is grown in Germany, and furnishes leaves for snuff, seldom for smoking.

(*b.*) *N. Augustifolia lanceolata.*—Leaves lancet-shaped, long-pointed, narrowing at the base. It furnishes snuff.

(*c.*) *N. Augustifolia pendulifolia.*—Leaves long, narrow and hanging downwards. Snuff tobacco.

(*d.*) *N. Augustifolia latifolia.*—Broad-leaved Virginian tobacco. Leaves broad, oblong, smooth and gummy, dropping a little. Chiefly used for snuff.

(*e.*) *N. Augustifolia undulata.*—Wave like Virginia tobacco. Leaves of this species are undulated and mature in a short time.

(*f.*) *N. Augustifolia pandurata.*—Leaves fiddle-shaped, three times as long as broad and thin. This variety furnishes good leaves for smoking, produces heavily and is much grown in Germany. It is said that the same is grown at the Pruth under the name of Tempyki and highly esteemed there.

2. Sub-species—*Stalked Virginian tobacco.*

(*a.*) *N. Augustifolia alata.*—Leaves lancet-shaped, stalks winged.

(*b.*) *N. Augustifolia lanceolata.*—*N. Fructiosa.*—This variety is sometimes enumerated as a separate species. Leaves lancet-shaped; plants growing to 8 feet in height.

(*c.*) *N. Augustifolia oblonga.*—Leaves oblong egg-shaped.

(*d.*) *N. Augustifolia cordata.*—East Indian tobacco. Leaves heart-shaped, or heart egg-shaped, pointed and overhanging. This variety produces heavily in good soil; it is well adapted for snuff, but not for smoking tobacco.

III. NICOTIANA RUSTICA.—Common tobacco. Hungarian tobacco, Turkish tobacco. *Leaves* stalked, egg-shaped or oval. *Corolla* tube short, segment of corolla rounded. Flowers yellowish green. *Stem* much branched and only about 2 feet high.

(*a.*) *N. Rustica cordata.*—Large leaved Hungarian tobacco. Brazilian tobacco, Turkish tobacco, Asiatic tobacco. This variety furnishes leaves for smoking tobacco.

(*b.*) *N. Rustica ovata.*—Small leaved Hungarian tobacco. The leaves are small, egg-shaped, and smooth. This variety furnishes fine aromatic leaves for smoking, but the yield is low.

IV. NICOTIANA CRISPA.—*Stem* very much branched and covered with white hairs. *Leaves* small, stalkless and clasping the stem. *Flowers* red. This species is much cultivated in Syria, Calabria, and Central Asia, and furnishes the leaves for the celebrated cigars of the Levant.

V. NICOTIANA PERSICA.—The flowers of this species are white. The Shiraz tobacco is obtained from this species.

VI. NICOTIANA REPANDA.—Cultivated in Cuba, and also in Germany.

VII. NICOTIANA PANICULATA.—Has yellowish green flowers.

VIII. NICOTIANA GLUTINOSA.—Clammy tobacco.

IX. NICOTIANA GLAUCA.—*Plants* grow tree-like and attain a height of 18 feet.

The three last mentioned species are not of much value to the agriculturist. There are many other species which are only of interest to the Botanist, and are sometimes cultivated as ornamental plants in gardens.

CONSTITUENTS.

7. *Nicotin.*—This is a volatile and, when pure, oil-like colorless liquid, possessing powerful narcotic and poisonous qualities, and the characteristic odour of tobacco; it consists, according to Melsens and Schlossing, of C. 20, H. 14, N. 2. Although green tobacco plants contain generally more nicotin than the leaves after they have been prepared for the market, yet the odour is only perceptible after the fermentation of the leaves has set in. It has been ascertained that young leaves 2 inches long contained 2·8 per cent., and leaves 10·5 inches broad and 16 inches long as much as 5·6 per cent. of their weight on Nicotin. The amount of Nicotin increases as the plants become ripe and decreases on their becoming overripe.

8. Though the narcotic effects of tobacco experienced by the smoker must partly be attributed to nicotin, it cannot be said that they are solely due, as it is often assumed, to nicotin. It is well known that the products of combustion of quite harmless substances are often stupifying. Good Syrian tobacco contains no nicotin, yet smokers consider cigars made from this tobacco to be strong. It is evident that the strength of a cigar, as judged by the smoker, depends greatly on the circumstance whether a cigar burns well or not. If a cigar burns well a greater amount of nicotin is consumed and decomposed and less of the above-mentioned narcotic products of combustion are created, than with one which burns badly. Cigars of the latter description containing little nicotin, are more narcotic in their effects when smoked than well burning cigars containing much nicotin.

9. The amount of nicotin in tobacco varies very much according to the species, the climate, the nature of soil in which the plant grew, the treatment received during its growth, and the course adopted to prepare the leaf for the market. Dr. Nessler, Director of the Agricultural Experimental Station at Carlsruhe, who made numerous analyses of tobacco, found that good Syrian tobacco contained no nicotin, Havana tobaccos between 0·6 and 2·0 per cent., and German tobaccos

between 0·7 and 3·3 per cent. Schlossing found in French tobacco nearly as much as 8·0 per cent. of nicotin. Fine tobaccos contain generally little or no nicotin. Mr. Broughton, who made many analyses of Indian tobaccos, with the view chiefly to ascertain the presence of a few constituents, found that the amount of nicotin varies very much in them.

10. The conditions that are favorable to the development of nicotin in the plants are:—soil in a bad physical state, strong nitrogenous manure, a dry atmosphere and probably a low temperature during the growth.

11. *Ammonia.*—According to Nessler, green and newly-cut tobacco plants contain no ammonia; the same is developed during the drying and fermentation of the leaves, especially when the tobacco leaves assume a brown color. Tobacco leaves, which have undergone a strong fermentation, contain more ammonia than those slightly fermented. Fine tobaccos contain generally less ammonia than coarser ones.

Nessler found in—

Havana smoking tobacco	...	...	...	...	0·2	per cent.	of ammonia.
Cuba do.	...	...	...	...	0·3	do.	
Syrian do.	...	...	...	...	0·6	do.	
German as much	...	...	...	...	0·9	do.	

Schlossing found that Havana tobacco contained as much as 0·8 per cent. of ammonia.

12. *Nitric acid*, consisting of nitrogen and oxygen, is formed in animal and plant substances when the same decompose under the influence of atmospheric air and a sufficiently high temperature, whereas ammonia, consisting of nitrogen and hydrogen, is formed when those substances decompose in the absence, or in the presence of little atmospheric air. Organic substances decomposing under the last-named conditions emit an objectionable pungent odor, which must partly be attributed to the formation of ammonia. Tobacco soon after harvesting commences, according to the conditions under which it is placed, one of the above enumerated decompositions. The extent of the decomposition the tobacco has gone through may be partly judged from the color the leaves have attained. If leaves be dried so rapidly as to remain green, the decomposition is probably confined to the formation of carbonic acid. A yellow color indicates the formation of nitric acid, and a dark, brown, and black color that of ammonia. The conditions under which inorganic nitrogenous substances nitric acid and ammonia are formed being known, it is evident that we have it in our power to cause the development either of nitric acid, or of ammonia. When the tobacco is hung far apart, so that the air has free access, the formation of nitric acid will take place; but if the air be excluded more or less by hanging the tobacco very close, or pressing the same in heaps, or pits, the formation of ammonia is engendered.

13. Nitric acid promotes generally the combustion of plant substances, owing to its supplying a portion of the needed oxygen, and has undoubtedly a similar effect in tobacco; its occurrence in the tobacco is therefore a desideratum with the cultivator and manufacturer of this article, and to supply any deficiency, the manufacturer often resorts to impregnating his tobacco with a solution of saltpetre. From this however it must not be concluded that every tobacco containing a large amount of nitric acid must necessarily burn well. Schlossing and Nessler have shown that the well burning of a tobacco does not always correspond with a great amount of nitric acid, thus indicating that other substances, or other conditions also affect the combustibility of tobacco. The effect of the nitric acid will most probably vary with the base with which the nitric acid is in combination.

14. *Albuminoids.*—The nitrogen in the form of nicotin, ammonia, and nitric acid, constitutes only a small portion of the total amount of nitrogen in tobacco, and by far the greater portion, viz., $\frac{2}{3}$ to $\frac{7}{8}$ of the total amount exists in the form of albuminoids. Nessler found that the nitrogen under this form varies from 2—4

per cent., which is equal to 13—26 per cent. of albuminoids. Substances, rich in albuminoids burn generally badly, and emit a pungent noxious odor. On the condition of these albuminoids, and on the presence of other substances, as nitric acid, alkalies, &c., in the tobacco, depends, mostly, the burning qualities of the leaf, and the flavor of a cigar.

15. Whilst drying and fermenting, the tobacco undergoes great changes. Some substances are decomposed, others are newly formed. The highly complicated compounds, the albuminoids, undergo first decomposition, and in doing so give birth to more simple combinations. Nitric acid, ammonia, and other substances less known are chiefly, if not entirely, derived from the products of the decomposition of albuminoids. The substances that cause the objectionable pungent smell in tobacco are formed from the broken up constituents of these high combinations. The conditions, under which these bad smelling combinations originate, are not properly known, but it is probable that they are developed with, and under the same conditions that cause the formation of ammonia, as the disagreeable pungent flavor is found generally in tobacco that has undergone fermentation to a great extent. It is believed that the conditions that favor the development of nicotin are also conducive to the formation of albuminous substances in the leaf, viz., fresh nitrogenous manure, bad physical state of the soil, &c.

16. *Cellulose.*—According to Nessler, the quality of tobacco depends to a great degree on the amount of cellulose it contains. He found that a good tobacco contained invariably more of this carbonaceous combination than a bad one; Havana yielding as much as 46 per cent. of cellulose. The fact that tobacco burns better after being stored for a time may be partly due to an increase of cellulose in it.

17. *Fatty matters, &c.*—Every tobacco contains more or less fat, gum, ethereal oil, &c. It is not properly known in what way fatty matters affect the quality of tobacco. Many other organic matters exist in tobacco in combination with substances from which it is most difficult to separate them, and have not as yet been quantitatively ascertained and are therefore little known. Most of them are only developed during drying and fermenting the leaf; their presence however considerably affects the quality of the tobacco. The substance, that gives rise to the aroma of the tobacco, consists, as far it is known, of Nicotianin and of an essential oil. Posselt and Reimann found 1 part of Nicotianin in 10,000 parts of green tobacco.

18. *Ash.*—The amount of ash constituents in the tobacco is considerable. The tobacco analysed by Nessler yielded, generally, between 19 and 27 per cent., whereas the Indian tobaccos analysed by Broughton, yielded ash varying between 16 and 28 per cent. It cannot be said that a definite relation between the total amount of ash in the tobacco and its quality exists, as tobaccos yielding much ash are sometimes of good and at other times of bad quality: a good tobacco may yield much or little ash.

19. The relative proportion in which the ash constituents exist is, however, of the greatest importance. It has been ascertained that the presence of some special mineral elements modify to a great extent the quality of the tobacco. Of all ash constituents potash (K_2O) more correctly speaking potassium carbonate (K_2CO_3) affects the quality of tobacco in the highest degree. Schlossing was the first who pointed out in the year 1860, that the good burning qualities of a tobacco depend on the presence of potash in combination with a vegetable acid in it; that a soil deficient in potash is unfit to produce tobacco of good quality. All the numerous analyses made since that time, have tended not only to corroborate the assertion made by Schlossing, but to demonstrate also, that it is not the *total* amount of potash, but the potash found as carbonate of potash, which existed in the plant in combination with a vegetable acid, that is the constituent chiefly affecting the combustibility of a tobacco. The complete analyses of Nessler have shown that, although a tobacco may contain a great amount of potash, it does not necessarily follow that the tobacco burns well;

Good burning dependent on presence of potassium in the form of a carbonate.

he found that some German tobaccos contained more potash than Havana, although the latter burned much better than the former, and that a great amount of potash, did not always indicate a great amount of carbonate of potash.

20. The following analysis made by Nessler illustrates better what is meant :—

Name of Tobacco.	Total Amount of Potash.	Carbonated Potash.	Total Ash.	Remarks.
	per cent.	per cent.	per cent.	
1. Havana ...	2·93	2·3	24·6	Small thin leaf burning very well and aromatic.
2. Syrian	2·753	3·42	20·685	Finely cut tobacco, burns well and is very aromatic.
3. German	6·246	5·21	22·343	Large thin leaf, burns very well and is aromatic
4. Do.	1·913	0·15	22·591	Burns very badly, goes out easily.
5. Do.	2·766	0·07	24·219	Do. do. do.
6. Do.	3·066	1·06	25·533	Do. do. do.

21. The three first named tobaccos, containing much carbonate of potash, burn well, whereas the last three, containing little of that combination, burn badly. The difference between the total amount of potash, and carbonate of potash, is especially striking when comparing No. 2 and No. 5, which contain nearly the same amount of potash. Although tobaccos, yielding a great amount of carbonate of potash in their ash, burn well generally, yet there may be conditions which neutralize the good effect of this combination, as a great amount of albuminoids, &c. It may therefore be said that the combustibility of a tobacco is improved in proportion as its ash yields more carbonate of potash, other conditions being equal.

22. Among the other salts, the chlorides deserve most attention.

The minor constituents of the ash.

23. It has been found that chlorides generally retard the burning of tobacco, and in proportion as they increase, carbonate of potash decreases. Lime is invariably found more or less in the ash. It has not been ascertained to what extent the presence of lime affects the quality of the tobacco. It has been found that good tobacco may contain more or less of this constituent, so that, it would appear that the function of lime in this respect is not a very important one. The same applies also to soda (Na_2O) magnesia (MgO) and phosphoric acid (P_2O_5). According to the analyses of Nessler in 100 lb. of dry tobacco the amount of—

Potash varies from	1·95 to 5·00	per cent.
Lime	6·5 to 9·2	do.
Soda	0·0 to 1·63	do.
Magnesia	0·12 to 0·99	do.
Phosphoric acid	0·57 to 1·39	do.

Conditions affecting the Growth and Quality of Tobacco.

24. *Climate.*—Of the many varied conditions affecting the quality of tobacco, the most important is the climate. The other conditions that must be fulfilled in order to succeed in the cultivation of this crop may be modified, or even sometimes created, to suit the purpose, but individual cultivators can do little with reference to climate ; the utmost they can do is to change the cultivating season and this only in places where tobacco can be grown nearly throughout the year. The aromatic principles, on the presence of which the value of a tobacco chiefly depends, can only be properly developed in the plant by the agency of high temperature and moisture. The fame that Cuban and Manilla tobaccos enjoy is mostly due to their particular climate. The article produced in Cuba is most highly esteemed ; up to this time, no other country has been able to compete successfully with this island. However it

Warm moist climate favorable to production of good tobacco.

cannot be doubted that there are many places whose climate justifies the assumption that a tobacco could be grown there, not inferior to that produced in the West Indies. The more closely the climate of a place corresponds with that of Cuba, the greater chance is there that a Havana variety will preserve its peculiar aroma. In such places a fine and valuable tobacco may be grown with less expenditure on labor, &c., than it is necessary to bestow in raising an inferior article in more inclement climes. In countries where a low temperature rules, the plants must be raised in hot beds, and there is also a great risk that the young plants may be destroyed by frost or afterwards by hailstones. When damp weather prevails during the tobacco harvest it is often injured; and to give the required flavor, &c., to make the article marketable, macerating has often to be resorted to, thus involving great risk and expenditure. But in spite of these drawbacks tobacco cultivation is often very remuneratively carried out in countries possessing an unfavorable climate. The deficient climatic conditions are here partly compensated for, by making the other conditions affecting the quality of tobacco, and which can be controlled by the cultivator, the most favorable for the production of this commodity.

25. *Soil.*—Next to climate must be mentioned the soil, as affecting to a great extent the quality of a tobacco. The tobacco plant thrives best in a soil rich in vegetable mould. The vegetable mould is however not so much required to supply the necessary plant food, as to keep the soil in a good physical condition. It may be said that no other plant requires the soil in such a friable state as tobacco. A light soil, sand or sandy loam, containing an average amount of organic matter and well drained, is considered best adapted for raising smoking tobacco; such a soil produces the finest leaves. The more organic matter a soil contains the heavier is the outturn; the leaves however become thicker and the aroma less. As in tropical climates the physical properties of the soil play a prominent part in its productive capabilities generally, and the presence of organic matter in the soil tends to improve these properties, it will rarely occur that in such places a soil will be found that contains too much humus. The more clay a soil contains the less it is adapted to the production of fine smoking tobacco, on account of its physical properties being less favorable to the development of the aromatic principles in the leaf, which becomes also generally thick and coarse, but the outturn on such soils is generally heavier than on a more sandy one. A clay soil however possessing a great amount of humus may, if properly tilled, produce an ordinary smoking tobacco, and may even, if great attention is paid to the selection of the variety, &c., produce leaves for cigar wrappers.

Light soil best adapted to growth of tobacco.

Clay soils not adapted.

26. Of less importance, than the physical properties of the soil, is its chemical composition. By proper tillage and heavy manuring, tobacco is sometimes grown in comparatively poor soils. On the Saidapet Farm one of the poorest soils, consisting mostly of coarse sand, which was unable to produce any crop previously, was dug over to the depth of $1\frac{1}{2}$ feet several times during the past year and heavily manured, and was planted with tobacco during the last dry season and produced plants as much as 8 feet in height with from 16 to 24 well developed leaves on each plant. From the analysis of the tobacco plant, it is clear that tobacco contains a great amount of ash constituents, which are removed by the plant from the soil; the most important of these are potash and lime. As a soil destitute of these constituents would require a great amount of manure to supply the wants of tobacco, it is very important that a soil intended for tobacco cultivation should contain a certain amount of potash and lime.

27. *Situation of the land.*—Land intended for tobacco culture should have good drainage, and be sheltered from high winds. In Holland, where tobacco cultivation is carried out to great perfection, each field is surrounded by a hedge about 7 feet high; the fields are divided into small plots, which are again bordered by rows of plants that are able to break the force of the wind, which would injure the leaves and render them of comparatively little value. To this circumstance must chiefly be attributed the fact that the Dutchman succeeds in getting as much as

50 per cent. of leaves of the first quality, whereas in most other countries 25 per cent. is considered to be a very good outturn.

28. *Manure.*—The quality of a tobacco depending to a great extent on the nature of its constituents, the raw materials out of which the plant is built up must necessarily play a prominent part in its cultivation. The tobacco plant being rich in inorganic matter draws these materials chiefly from the soil. The soil must not only be able to supply the plants with the elements necessary for its growth, but it must contain these in such a form and quantity as to be most conducive to the development of these varied conditions in the leaf, on the presence of which the good quality of a tobacco chiefly depends. In its natural state, the soil will rarely possess the elements of plant food in such a form as is most conducive to the production of a fine tobacco leaf. Any deficiency of the necessary plant food must be supplied in the shape of suitable manure. Schlossing was the first who made scientific experiments to ascertain under what conditions a soil is enabled to produce fine tobacco. He found that a bad burning tobacco was produced on a soil containing little potash, on unmanured soil, on soil manured with flesh, humus, with Calcium chloride, Magnesium chloride and Potassium chloride. A good burning tobacco was produced on a soil manured with Potassium carbonate, with saltpetre and with Potassium sulphate. More recent experiments carried out by other investigators tend to corroborate these conclusions. It is generally assumed that a soil rich in nitrogenous organic matter produces a strong tobacco that burns badly.

29. The following table shows the results of some experiments made by Schlossing, in growing tobacco in a field near Boulogne in France, taken from "L. Von Wagner's tobacco and cigar manufactory":—

Number.	Manure per Hectare.*					100 parts leaves with 10 per cent. of water contained					
			Salt.								
	Flesh in Kilogramme.†	Compost in Kilogramme.	Nature of Salt.	Quantity in Kilogramme.	Containing Potash Kilogramme.	KO.	CaO.	MgO.	SO_3.	Cl.	Nicotin.
1	...	...	...	...	...	1·04	7·73	0·99	0·99	0·70	8·27
2	3,300	11,500	...	...	...	0·98	7·48	0·81	0·93	0·55	8·95
3	3,300	11,500	KO, SO_3	666	360	2·66	6·58	0·78	0·97	0·43	8·05
4	3,300	11,500	KCl	570	360	1·74	7·17	0·73	0·87	1·64	7·96
5	3,300	11,500	KO, NO_5	773	360	2·13	6·26	0·64	0·79	0·38	7·65
6	3,300	11,500	KO, CO_2	265	180	1·65	7·34	0·64	0·96	0·44	8·78
7	3,300	11,500	KO, CO_2	530	360	2·24	6·24	0·65	0·84	0·42	8·43
8	3,300	11,500	KO, CO_2	1,060	720	2·50	6·61	0·65	1·05	0·54	8·27
9	3,300	11,500	Ca, Cl	432	720	1·16	8·47	0·97	0·85	1·77	8·27
10	3,300	11,500	Mg, Cl	213	720	0·82	8·29	1·09	0·77	1·69	8·00
11	3,300	11,500	KO, SiO_3	500	110	1·39	7·74	0·92	0·98	1·69	7·98
12	3,300	11,500	KO, SiO_3	1,000	220	1·99	7·44	0·78	1·06	0·50	8·17

* One Hectare = 2·47 acres. † One Kilogramme = 2·2 lb.

30. The extraordinarily high percentage of nicotin found in this tobacco is undoubtedly due to the heavy manuring with nitrogenous organic substance in the shape of flesh, &c. The quantity of salts applied as manure appears in some instances to be unusually large.

31. The following is an analysis of a soil made by Nessler, on which he conducted part of his tobacco cultivation experiments :—

	100 parts of soil dried by 212 degrees contained								
	Organic matter.	Mineral matters soluble in hot Hydrochloric acid.							
		Phosphoric Acid.	Potash.	Soda.	Magnesia.	Lime.	Oxide of Iron.	Albumina.	Silica.
Surface soil	2·50	0·163	0·125	0·123	0·076	0·260	3·392	0·253	0·074
Subsoil	2·22	0·159	0·101	0·070	0·221	0·229	Not ascertained	4·065	0·023
		Insoluble inorganic matter.							
Surface soil	...	...	1·382	0·943	0·252	0·599	...	6·652	83·382
Subsoil	...	...	1·114	0·630	0·108	0·266	...	5·751	84·862
		Soluble in water.							
Surface soil	...	...	0·0034	0·0016	0·031	...	...	...	...
Subsoil	...	...	0·0063	0·0013	0·029	...	...	...	...

32. The following table shows an analysis made by Nessler of the tobacco grown on the above soil.

Number.	Manure.		Size of leaves.		Produce per Acre.	100 parts of Dry Tobacco contain.							
	Nature of Manure.	lb. per Acre.	Length in Inches.	Breadth in Inches.		Ash.	Carbonate of Potash.	Carbonate of Lime.	Potash.	Soda.	Nicotin.	Nitrogen.	Fat.
1	No manure	...	18	8½	6,320	...	...	...	...	...	...	...	...
2	Superphosphate ...	400	17½	8½	6,094	21·40	1·16	...	3·09	0·43	...	3·23	4·50
3	Chloride of Potash ...	300	18½	9	8,120	23·02	0·42	14·90	3·62	0·87	0·831	3·29	...
4	Sulphate of Potash ...	300	18	9	5,540	21·07	1·40	15·03	3·39	0·72	...	3·11	3·94
5	Common salt ...	300	17	8	7,560	24·47	0·47	16·84	2·06	0·43	0·58	2·15	3·65
6	Carbonate of Potash.	150	18½	7½	4,620	21·96	2·51	...	3·08	0·44	0·57	3·21	3·42
7	Feldspar	1,000	18	8½	5,830	22·19	1·23	18·04	2·86	1·00	0·94	3·07	...
8	No manure	...	17½	8½	4,410	20·43	1·13	18·71	2·76	1·10	0·50	3·12	...
9	Carnallite	400	18	8	6,200	21·70	1·05	14·41	3·42	0·87	0·93	3·01	...
10	Sulphate of Magnesia.	400	16½	7	4,580	21·70	1·03	14·40	2·90	0·93	0·69	3·02	...
11	Gypsum	400	15	8	4,290	22·68	1·60	...	2·83	0·92	...	...	...
12	Sulphate of Ammonia.	160	16½	7½	4,080	24·79	0·86	16·68	2·15	0·71	0·80	3·14	3·86
13	Sulphate of Ammonia.	160	17	9	5,090	23·01	1·40	...	2·89	0·71	...	2·80	4·40
	Sulphate of Potash.	300											
	Superphosphate ...	400											
14	Feldspar	1,000	18	8½	3,530	...	...	...	...	...	...	...	...

33. To ascertain the influence of the various manures on the combustibility of tobacco, Nessler cut out equal sized strips from the leaves and kindled them on a lamp when he found that the tobacco—

No.	Manured with	Kept fire in Seconds.	Contained Carbonate of Potash in the ash.
1	Carbonate of Potash	17	2·51
2	Sulphate of Potash	15½	1·4
3	Gypsum	13½	1·6
4	Feldspar No. 14	13	...
5	Nothing	11	...
6	Feldspar No. 7	10	1·23
7	Carnallite	10	1·05
8	Superphosphate	10	1·16
9	Chloride of Potash	10	0·42
10	Nothing No. 1	10	1·13
11	Mixture	10	1·40
12	Sulphate of Ammonia	8½	0·86
13	Sulphate of Magnesia	7½	1·03
14	Common salt	4½	0·47

34. According to Nessler although all the tobacco, experimented with, shown in the last table burnt pretty well, yet the effect of the manure was very marked on the 4 at the top of the list which were the best and the 3 at the bottom which were the worst.

35. The foregoing table clearly shows that it is not sufficient to apply the element most needed by the plant—potash—in any form, but to produce a good tobacco it is necessary to apply it in a particular combination. It is to be seen that *carbonate of potash* applied as manure produced the best tobacco; this tobacco burnt for the longest time and its ash contained most carbonate of potash, whereas chloride of potash produced a much inferior tobacco. The assertion of other experimenters that chlorides produce a bad tobacco is thus confirmed. *Sulphate of potash* and *sulphate of lime* produced a good tobacco. It may be noticed here that tobacco, manured with gypsum, contained a great amount of *carbonate of potash* in the ash, which is most probably due to the fact that gypsum is a good solvent for the inert potash salts. From the foregoing it may be concluded that in tobacco cultivation, the elements chiefly removed from the soil, potassium and calcium should be restored in the form of carbonates, sulphates or nitrates, but not as chlorides.

36. Poudrette which generally contains a considerable amount of chlorides is therefore not well suited as manure for fine tabacco. It has been found that fields manured with chlorides produce heavily; a small proportion of chlorides may therefore be applied in this form whenever quality is of less importance than quantity. Fold yard manure may suffice when tobacco is cultivated in proper rotation, but also here, unless the soil be very rich in potassium and calcium, the application of some special manure will greatly enhance the value of the outturn. Good wood ashes are a valuable supplement to stable dung. Gypsum is an excellent manure for soils in good manural condition, it supplies the lime needed by the tobacco and acts as a solvent on the inert potash salts. Gypsum applied on poor land, however, hastens the exhaustion of the soil.

37. It is said that crops manured with gypsum suffer less from the effects of drought and require less irrigation, than when manured otherwise; the leaves of plants that had been manured with gypsum exhaling less water than when manured with other substance. If this assumption should be found to be correct, gypsum as manure would be invaluable to the Indian cultivator.

38. With regard to the amount of manure to be employed, it may be mentioned that, with fold yard manure properly rotted there is no theoretical limit, especially when the tobacco is intended for snuff and is grown in a hot climate, where the physical properties of the soil is of utmost importance in tobacco cultivation. It is said that in Rhenish Bavaria some soil contained as much as 15 per cent. of organic matter, yet the cultivator considers it necessary to manure heavily to each tobacco

crop. The tobacco grower in Holland applies to his rich alluvial soil as much as 25 tons per acre of well rotted cattle manure. In America it is reported that the heaviest crops are obtained on soil newly taken up and very rich in vegetable mould. It is considered nearly everywhere that tobacco will pay best when heavily manured. The first care of even the poorest peasant in the tobacco districts of Germany, Holland, &c., as soon as he sells his tobacco, is to purchase manure which he considers essential to his success.

39. *Special Manures.*—The amount of special manure which can be applied without injury to the plants depends very much on the solubility of the stuff and the manner of applying it. Highly soluble salts, such as saltpetre, should be applied in smaller quantities than salts which only dissolve slowly. With regard to the manner of applying concentrated manures, it is evident that when a salt is applied in close proximity to the plant less will be required than when strewn over the whole field. When applied to the plants in solution not more than 300 lb. of saltpetre per acre should be used at one time. The amount to be applied varies also with the soil; a sandy soil, which has little absorptive power should receive less than a clay soil. Salts easily disintegrating should not be applied before tobacco has been planted, especially not before heavy rains which would carry off the salt. To supply the *potash* required by the tobacco plant 200 lb. of good saltpetre per acre would be sufficient in most cases. Lime, although removed from the soil in large quantities, is rarely applied to tobacco as a special manure. Where wood ashes can be had at a moderate price, lime may be applied in this form. Some ashes are very rich in lime. It has been found that ashes obtained from beach-wood contain 52 and that from oak-wood as much as 75 per cent. of lime.

The position of the Tobacco Crop in a Rotation.

40. A proper rotation of crops being advantageous generally, must be particularly so for the cultivator of tobacco, since tobacco requires a great amount of readily accessible inorganic matter in the soil, especially potash and lime. Although the importance of cultivating tobacco in rotation is admitted, there may be circumstances that justify the growth of this crop successively for several years in the same field. In America tobacco is grown successively for several years on new land, that is virgin soil, where the elements of plant food exist in such abundance that the tobacco crop may be thus cultivated without for a time showing any notable decrease in yield; it is even said that the outturn of the second year is heavier than that of the first. In Hungary and Holland, the best tobacco is grown for many years in succession on the same land. There the plan is adopted partly out of necessity and partly for convenience. The small landholder is often obliged to grow tobacco on the same field, because he has only one piece of land properly fitted for tobacco cultivation; for the sake of convenience he grows his tobacco every year on the same place near his homestead, to allow him to pay the closest attention to his crop; he will however manure heavily. Nessler, in Carlsruhe, cultivated tobacco during six consecutive years in the same field without noticing any perceptible decrease in yield or quality. To admit of such a system the soil must either be very rich in the elements essential for the successful growth of tobacco or heavily manured, as is the practice in Holland. It is generally assumed that, when tobacco is grown on the same field in succession, the leaves do not become so large after the first year; but grow thicker and more gummy and contain less water.

41. From the foregoing it would appear, that although tobacco may be grown successfully on the same land in succession under special circumstances, the cultivator will find it advantageous to adopt some plan of rotation. Cereals and pulses are very well adapted for cultivation in the course of rotation. The reason for this is that tobacco removes but little phosphoric acid from the soil, the same must be enriched in the element most necessary for the growth of cereals. It has also been found that hemp thrives particularly well after tobacco.

42. *Selection of Species.*—Amongst the many requirements that must be fulfilled to ensure success in the cultivation of tobacco, not the least is the proper selection of species and variety. The cultivator must carefully compare the demands that the different varieties make and the means at his disposal to satisfy them, before he makes his selection. Although tobacco is a hardy plant and grows under varied conditions, yet to become a remunerative crop, the plant should not be placed under circumstances much dissimilar to those to which it is accustomed. By the agency of these circumstances the characteristics of the different species and varieties have been chiefly developed; the absence of the agents must necessarily involve an alteration in the product. Thus it is evident that by importing seed of a fine species directly from its native land, the plants will not retain in the new habitat all their special qualities, unless climate, soil and treatment are nearly the same. It is true that some fine species of tobacco, which have been introduced in Germany, Hungary, Holland, &c., are successfully cultivated there, and are highly valued; but the high price this tobacco commands there in some places, is not so much due to those qualities for the sake of which they are so highly esteemed in their native land—the aroma—but to qualities resulting chiefly from the mode of cultivation and the treatment of the produce. By digging over his rich alluvial soil 2 feet deep, and manuring at the rate of 25 tons per acre; and paying the utmost attention to his tobacco the Dutchman is able to compete successfully with France and Hungary, and receives as much as Rupees 44 per 100 lb. and a gross income of Rupees 700 per acre planted with tobacco. Although this shows how far climatic deficiencies may, with regard to profitable cultivation, be supplanted by intelligence, yet it must be admitted that this can be done only under peculiar circumstance and applies especially to the small landholder. In selecting a species of tobacco the climate must first be considered. As shown above fine and valuable tobacco is a product of tropical countries. In a warm climate, possessing a certain amount of humidity, by employing common means, a tobacco may be raised that yields a profit not attainable in less favored regions. A warm moist climate admits the selection of those species of tobacco that command the highest prices; if to this be added a suitable soil and proper treatment of the tobacco, the cultivation of this plant yields a profit not easily obtainable by the production of any other crop.

43. The following table shows the price that the Austrian Government paid per 100 lb. of imported tobacco in 1868 :—

For Manilla	tobacco	...	...	...	89	florins.*
„ Havanna	do.	...	...	...	78	do.
„ European Turkish	do.	...	...	...	72	do.
„ Cuba	do.	...	...	...	34	do.
„ Asiatic Turkish	do.	...	...	...	26	do.
„ Varinas (Kanaster)	do.	...	...	...	48	do.
„ Syrian	do.	...	...	...	55	do.
„ Virginian	do.	...	...	...	35	do.
„ Brazilian	do.	...	...	...	23	do.
„ Kentucky	do.	...	...	...	35	do.
„ Java	do.	...	...	...	66	do.
„ Maryland	do.	...	...	...	29	do.
„ Holland	do.	...	...	...	26	do.

44. The highest price paid for Hungarian tobacco was only 22 florins per 100 lb. It will be noticed from this table that there is a great difference in the price. The Manilla and Havanna varieties commanded the highest prices, but it must be remembered that some Havanna tobaccos command a much higher price than these figures show. The highest price is commanded by the tobacco raised in Vuelta Abajo on the West coast of the island of Cuba, for which sometimes as much as Rupees 750 is paid for 100 lb., and as much as a rupee for a cigar. For tobacco raised in the interior Rupees 5 per lb. is frequently paid in Bremen.

*1 Florin is worth about 2 shillings.

45. The French Government sold nearly 200,000 kilogramme of imported genuine Havanna cigars in the year 1867, at an average price of 59 francs per kilogramme. The following table shows the details of this sale of Havanna cigars.

At the rate of	1	franc	50	centimes	were sold.	3,000	cigars.
Do.	1	do.	25	do.	...	1,500	do.
Do.		do.		do.	...	7,000	do.
Do.		do.	75	do.	...	80,000	do.
Do.		do.	60	do.	...	250,000	do.
Do.		do.	50	do.	...	560,000	do.
Do.		do.	40	do.	...	775,000	do.
Do.		do.	35	do.	...	705,000	do.
Do.		do.	30	do.	...	4,000,000	do.
Do.		do.	25	do.	...	4,180,000	do.
				Total	...	48,181,500	do.

By far the greatest number were sold of the sort last mentioned. It is calculated that 250 cigars weigh one kilogramme (about 2·2 lb.) Manillas were sold at the rate of 20 and 15 centimes per cigar. As of all tobaccos the Havanna varieties command the highest prices, the cultivator nearly everywhere attempts to introduce and to cultivate them. There is no great difficulty in raising plants of these varieties; the tobacco however speedily degenerates and forms new varieties, if the climatic conditions, &c., are not favorable. It would appear that Havanna tobaccos are not properly classified as yet, they apparently belong to several species.

46. The Virginian tobacco (*Nicotiana augustifolia*) was previously extensively cultivated but has of late been frequently displaced by the Maryland species. It is however still much favored by cultivators in temperate climates, as it does not require a high temperature. Virginian tobacco is on account of its botanical characteristics usually not much liked by the manufacturers of cigars; some varieties however that have less of the marked specific characters yield tolerably fine leaves for cigars. As the price of this tobacco is rather low, it is not so well suited for export as the *Macrophylla* species. Hungarian tobacco (*Nicotiana rustica*) is considered to be a very hardy, but a less valuable species than the foregoing. The leaves are generally small and possess a particular aroma.

47. A high price is generally commanded, irrespective of the species, by those tobaccos that possess a large smooth thin leaf, which is elastic and has a fine golden color and a good aroma; the ribs and veins should be thin and the former branch off from the mid-rib at nearly right angles and should be far apart from each other. The lower the percentage of the weight in ribs, the thinner and broader the leaf, the fewer of the same that are torn, the more wrappers can be cut out of 1 lb. of tobacco, other conditions being equal, and consequently the higher is the price of the article. The manufacturer of cigars often does not appreciate the aroma so much as the other qualities. He can do nothing to improve the botanical characters; the finest aromatic leaf would be of but little value to him, if it were torn; but he is able to improve by artificial means to a certain extent defects in flavor. Of all species, *Nicotiana macrophylla* is considered to possess the qualities that distinguish a good tobacco in the highest degree. Some of the Havanna tobaccos belong to this species as also the Ohio, the Ammerfort, Turkish and the Dutten tobaccos. The cultivation of this species assumes larger proportions every year and the number of varieties and sub-varieties increases accordingly.

Cultivation of the Crop.

48. *Raising Plants.*—A light friable soil being the best adapted for tobacco cultivation generally, is particularly well fitted for raising plants in the nursery. To obtain this, the soil intended for a nursery should be broken up to the depth of $1\frac{1}{2}$ foot some months before the sowing season. A drain should be dug round the nursery, and the soil thus obtained utilized in raising the surface. The best time for transplanting tobacco in the field in this neighbourhood would be imme-

diately after the north-east rains; the plants would then most probably reach maturity without the aid of irrigation, the moisture in the soil and the heavy dews at that time being sufficient; and, as for the production of a fine leaf a moist climate is considered necessary, the value of the outturn would be much enhanced. If however the seed had to be sown before the monsoon the young tender plants, unless carefully sheltered from the wind and heavy rains, would most probably succumb to the inclemency of the weather. It may therefore be assumed that where the rains are very heavy the time for sowing in India is immediately after the heavy rain of the monsoon is over. The soil should therefore in places enjoying the north-east monsoon like Madras, be broken up, not later than the end of August. Unless the soil be very rich in humus it should be heavily manured with well preserved farm-yard manure soon afterwards. The soil of a tobacco nursery cannot contain too much organic matter; it is said that one containing as much as 20 per cent. of this substance produced the most vigorous plants which developed a great number of fibrous roots. A soil containing much humus will prevent to a great extent the formation of a surface crust which is so detrimental to the development of the plants during their early growth, and will also facilitate the extraction of the plants when transplanting takes place. After a few weeks have elapsed the soil should be dug over a second time and the whole reduced to a fine tilth. The land may now remain untouched until the sowing time, unless weeds should spring up; these must be eradicated.

Best season for raising the plants.

Conditions favorable to the growth of plants.

49. The area required for a nursery depends on the area of ground to be planted and on the *distance the plants require to be planted in the field.* To plant an acre with tobacco plants 2 feet apart in each direction, 10,890; 3 feet in one and two in the other direction, 7,260; and to plant 3 feet apart in each direction, 4,840 plants are required. To ensure a healthy growth of the young plants about a square inch space should be allotted to each in the nursery. Taking the number of 7,260 plants as that required for an acre, and giving each plant 1 square inch room, an area of 7,000 square inches or 50 square feet would be required to raise plants sufficient for an acre. As however the plants are apt to be injured during their first growth and many are rendered useless in lifting them for transplanting, as also a number of plants must be kept as reserve to replace those that die after transplanting, the provident cultivator will do well to raise double the number of plants actually needed. It may therefore be laid down that 100 square feet of nursery bed is required to raise plants sufficient for an acre.

Area of nursery bed required.

50. The amount of seed required to raise plants for an acre depends chiefly on the vitality of the seed. An ounce of tobacco seed contains about 100,000 grains, so that, on the supposition that a plant can be raised from each grain, nearly 7 acres could be planted with the seedlings raised from one ounce of seed, according to the foregoing calculation. As, however, even the best tobacco seed has not a very high percentage of vitality between half an ounce and one ounce of seed is generally sown to produce the plants required for one acre.

Amount of seed to be sown.

51. The time of sowing having arrived, the nursery should be divided in beds. The most convenient arrangement would be for the sake of weeding, watering, &c., to divide the whole into beds 10 feet long and 5 feet wide making 50 square feet each, on which as seen above, plants for half an acre can easily be raised. As even with a small tobacco plantation, several days are required for transplanting, all the beds should not be sown at one time, but various plots should be sown at intervals of a few days. This will also lessen the risk of the young plants being all destroyed by a storm, insects, &c. Before sowing the seed, the soil should be dug over to the depth of 6 inches and levelled with a rake. The seed must then be sown evenly on the surface and beaten down slightly with the hand or otherwise. The seed being very small

Arrangements for sowing the nursery beds.

many cultivators mix it with ashes in order to be able to distribute it regularly over the bed. The seed must be covered only slightly; the best way to do this is to strew some fine compost manure over it. Ants, which often destroy the seeds, may be kept off by sprinkling some ashes over the bed. Finally some cut straw may be spread over the surface. To protect the nursery from the sun and rain, the whole should be covered with a roof made of straw, leaves, or cloth supported by poles. This roof should be only a few feet from the ground. The soil of the nursery must be kept constantly moist, but not wet. Watering with a fine rosed watering-pot will be required once or twice a day, according to weather and the amount of humus in the soil.

Manner of sowing the seed.

52. The plants, which will appear about a week after sowing, are very tender during the first stage of their growth, and require frequent watering: a little water only should be applied at one time with a watering-pot provided with a fine rose. The use of the straw will be apparent now; it will prevent the water falling with any force immediately on the plants, and prevent the wash of the soil from the fine rootlets. If the plants spring up very thickly they should be thinned out, when about a week or too old, leaving about 1 square inch space for each plant. The plants taken out may be used to fill blanks in the nursery bed, or, if there are more plants to be taken out than required for this purpose, they should be planted in a separate bed. It is universally acknowledged that plants transplanted when very young develope more roots, grow more vigorously, and become more hardy afterwards than when not transplanted at this stage of growth. When the plants are about two weeks old they require less attention, and should be watered less frequently to harden them before transplanting. Any weeds appearing must be removed and insects injurious to the plants must be killed. In about seven or eight weeks after sowing, the plants will be fit for transplanting.

Treatment of the young plants.

53. The land intended to be planted with tobacco should receive several deep ploughings not less than 9 inches deep. As a rule, a clay soil requires to be more deeply ploughed than a sandy or loamy soil. It greatly conduces to the success of tobacco cultivation, if the land is allowed to be fallow for several months before planting the crop, to admit of the proper preparation of the soil, by ploughing, rolling, harrowing, &c., and to allow the attainment of as fine a tilth as is usually liked by gardeners. No other crop will better repay the expense of proper preparation of the soil than tobacco; the fineness of the leaf, and the aroma of the tobacco depend to a great degree on the preparation of the soil. The land should be ridged immediately before planting. The distance apart at which to place the ridges depends on the quality of the soil and the species of plant to be raised. One species has large leaves, another has short ones; the leaves of some varieties stand at an acute angle and of others more nearly at right angles to the stem, thus occupying more or less space. With good soil the ridges must be made further apart than in a poor one, because a good soil produces larger leaves. On the Saidapet farm, leaves of tobacco were found to be as much as $2\frac{3}{4}$ feet long covering a circle of 2 feet radius. With such tobacco the ridges should be $3\frac{1}{2}$ to 4 feet apart, to allow a passage between the rows for the purpose of weeding, hoeing and suckering, &c., without breaking the leaves. In the lines the plants may be planted from 6 inches to 1 foot closer than the distance at which the ridges have been made. In some places a plough is run at right angles across the ridges before planting at the distance at which the plants have to stand in the lines, forming by this means small hills on which the seedlings are planted.

Preparation of the field.

Ploughing to be insisted on.

Distance apart at which to place the lines.

54. *Planting.*—The soil being prepared to receive the seedlings, the planting should take place only in the evening or at night, unless the weather be cloudy, when it may be performed during the whole day. Some hours before commencing transplanting, the nursery should be thoroughly watered to facilitate the removal of the plants without tearing their

Time for planting.

roots. If the plants are of an even size, so that all the plants of a bed can be removed, the best plan to follow would be to take them out with a spade, or trowel, leaving a lump of soil on each. In most cases however it will be necessary to take up each plant separately; this should be done very carefully, taking it with the thumb and forefinger as near as possible to the roots and drawing out the plants, if possible, with a little soil adhering to their roots. The plants should be taken at once in a basket to the field for planting. A woman going between two ridges should place a plant on each hill right and left. One woman is sufficient for two planters who follow her immediately. The planting is nearly the same as with cabbages, but requires more care, the plants being more tender, and their roots and leaves spring nearly from the same point, these are more difficult to handle. The plants should be placed in a hollow made on each hill, which will serve as reserver for the water to be applied and also afford some shade.

Removal from nursery bed.

Manner of planting.

55. The plants must be watered immediately after they are planted; they should also by some means be shaded during the first few days, which can easily be done when only a small area is planted, but is rather difficult to manage when tobacco is grown on a large scale. In the latter case the shade afforded by planting them in a slight cavity must suffice. If the plants have been taken from the nursery with some soil adhering to their roots, and are repeatedly watered during the first few days, few of them will die. When the weather is dry, water should be applied twice a day, viz., morning and evening, and after that time once daily until the plants have taken root, after which time occasional waterings varying with soil, weather, and species of plant must be given. In dry weather, and with a soil poor in humus, one watering every second or third day may be necessary, whereas with a soil rich in organic matter and in a moist atmosphere, watering may be entirely dispensed with. During the first few days the water should be applied with a watering-pot, which should be held very low, otherwise the soil would be washed from the plant-roots and expose them to the direct rays of the sun, which would cause the death of the plants.

Benefits of shading.

Watering.

56. After the plants have once taken root they grow rapidly. They should be hoed when about 6 to 9 inches high, and the soil drawn from the furrows to raise the hills maintaining a depression round the stems. If the soil is not very rich, a special manure should be applied at this stage of growth. The best manure generally will be saltpetre in a liquid state which can be applied in the depression around the plants with a watering-pot. By applying the saltpetre in solution and close to the plant less is required than when spread ever the whole field; 200 lb. of saltpetre per acre were applied on the Saidapet Farm in the way described with good results. Some weeks afterwards another hoeing and heaping of earth round the plants will be necessary. It is most difficult to say the number of hoeings which may be required by a tobacco crop. The general rule to be followed is to keep the soil loose, friable and free from weeds. The more organic matter the soil contains the more will it remain loose and friable; the less organic matter the more waterings will be required, which causes the soil to crust over and to assume a close texture, and necessitates frequent hoeings. As long as the plants have not spread much the hoeing may be done by a cultivator drawn by cattle followed by some men to perform the heaping. Insects which attack the tobacco must be killed at once. They can easily be discovered in the mornings; if not killed at once they are sometimes able to destroy the whole crop in a few days.

After cultivation.

Application of special manure.

Necessity of hoeings.

57. *Topping and Suckering.*—The plants will commence to flower about two months after planting, when from 2 to 7 feet high, according to quality of soil and species of plants. When the flower buds appear, they must be broken off, and with them the top and also the bottom leaves.

Time for topping.

By breaking off the flower buds at an early date the sap that would be used to the formation of these organs flows to the leaves, which thereby increase in size and the outturn becomes much heavier than when the plant is allowed to flower. But it is generally admitted that the leaves lose much in aroma. To what extent the early removal of the flower buds impairs the quality has, I believe, not been properly investigated. It is very probable that the greater yield does not always compensate the loss in quality. The bottom leaves are generally of inferior quality, small, torn and dirty. The number of leaves to be left on plant varies greatly according to the species, quality of soil, and method of cultivation. Tobacco plants raised on the Saidapet Farm, on a very sandy soil, matured as many as 24 leaves: the following are the measurements of the leaves of some plants :—

Effect of topping.

Number.	Height of Plant in Feet.	Number of Leaves.	Name and Number of Leaves.	Measurements.	
				Length.	Breadth.
			Plants raised from Seed received from Madura (a Virginian variety).	INCHES.	INCHES.
1	8	22	4 Bottom leaves (sand gut)	27	8
			9 Next upper leaves (erd gut)	27	12
			4 Next upper ones (best gut)	24	8
			5 Top leaves	21	7
2	8	23	5 Bottom leaves (sand gut)	24	10
			6 Next upper leaves (erd gut)	27	14
			6 Next upper leaves (best gut)	24	11
			6 Top leaves	21	8
			Plants raised from Kentucky Tobacco seed received from America (apparently a Virginian variety).		
1	4½	24	8 Bottom leaves (sand gut)	30	14
			8 Next upper leaves (erd gut)	30	15
			8 Next upper leaves (best gut)	20	11
2	5	20	8 Bottom leaves (sand gut)	24	13
			8 Next upper leaves (erd gut)	27	15
			4 Next upper leaves (best gut)	24	12

58. The stalks of these tobaccos were very much winged, the wings were included in the measurement of the leaves. In measuring the height, the flower buds were included. It should be noted that these plants were allowed to run to seed; if they had been topped the leaves would have grown larger. The Kentucky tobacco matured as many leaves on a low stem as the Madura tobacco on a high one; the leaves were very closely arranged on the stem, whereas on the Madura tobacco they stood far apart.

59. The number of leaves may therefore vary between 6 and 22. The only rule to be observed is to retain as many leaves as the plants are able to mature. Soon after the plants have been topped suckers appear in the axils of the leaves; these should be broken off as soon as they appear, at least they should not be allowed to grow longer than 4 inches. If the suckers are not removed soon after their appearance, the size of the leaves will be seriously impaired. After the plants are once half-grown great care must be taken when going through the lines, either for the purpose of hoeing, watering, or suckering, &c., not to tear the leaves; hoeing and suckering should be performed only when the leaves have lost part of their turgescence attained at night. Insects, however, must be killed during the morning and evening, at other times they are not easily found. Leaves, which are torn, are not fit for wrappers and must often be thrown on the refuse heap as valueless, even if well developed and of good color.

Suckering when necessary.

60. The plants commence to ripen about three months after being planted; this is indicated by the leaves assuming a marbled appearance and a yellowish green color. The leaves also generally become gummy and the tips bend downwards. It is considered that tobacco intended for snuff should have attained more maturity than tobacco for smoking. Nessler found that the less ripe leaves contained more carbonate of potash and burnt consequently *better* than the more ripe ones, but the total amount of potash was larger in the latter than in the former; cigars made from less ripe leaves kept the fire when lighted for a *shorter time* than those made from more ripe leaves.

61. *Harvesting.*—The leaf being matured, it should be harvested only after the dew is off the plants and not on a rainy day. There are two modes of harvesting—

Methods of gathering.

gathering the leaves singly, and cutting down the whole plant. Gathering single leaves admits of removing them from the plant as they ripen; the bottom leaves are removed first and the top leaves left some time longer until they have attained full maturity. The cultivator is thereby enabled to gather his crop when it possesses the greatest value. This plan necessitates however a great amount of labor, and in a hot climate the single leaves are apt to dry so rapidly as not to attain a proper color, unless stacked early in heaps. Stacking in heaps however involves great risk of the leaves heating too much and developing a bad flavor, whereby the tobacco loses more or less in value. For Indian circumstances generally, I believe, that cutting the whole plants is better adapted than gathering the leaves singly.

62. For cutting down the plants a long knife or chopper should be used. The man taking the plant with his left hand about 9 inches from the ground, and with

Means of cutting.

the knife in his right hand cuts through the stem of the plant just above the ground. If the plants are sufficiently wilted he may lay the plant on the ground and proceed to cut down others; if however the plants are so brittle as to cause the leaves to be injured by laying them down, he should give the plants to another person to carry them at once under shade. During bright weather, the plant should not be allowed to lie exposed to the sun on the ground, or they will become sun-burnt and lose in value. A temporary shed should be erected; a light roof made of palm leaves or thatched with straw, supported by poles is all that is wanted; a large tree standing near will also serve for the purpose. Under this shade some parallel rows of posts should have

Treatment of plants in the field.

been put up and on the posts light poles or strong bamboos fixed horizontally. The parallel lines should be about 4½ feet apart and the horizontal poles about 4 to 5 feet from the ground according to the height of the tobacco plants. Bamboos should have been cut previously in lengths of 5 feet. The bamboo pieces should be laid over these parallel bars so that they will project about 3 inches at each end. The tobacco plants that have been cut down should be immediately brought into the shade tied in pairs and hung across the bamboos. Plantain fibre for tieing the plants together answers well; 8 to 16 plants may be hung on each bamboo according to their size. The plants must not be hung so close as to press each other, and the bamboos should therefore be 6 inches to a foot apart. The frame-work should be so large as to allow of one day's cutting being hung. The plants should be left thus one day during which time they will be sufficiently wilted, to allow handling without tearing the leaves. If a very dry wind should be blowing, some mats or some other cover should be laid against the plants most exposed to it, or the leaves of these plants will dry rapidly, shrivel up, and remain green. The next day the leaves should be

Transporting to the drying shed.

carted to the drying-shed. A cart supplied with a frame-work in order that the plants may be hung as they were hung under the shade will be the best means of taking the leaves to the shed. Perpendicular uprights at each corner of a cart or waggon fixed together by horizontal poles are all that is wanted. The plants may be hung so close on the waggon or cart as not to press heavily on each other; 200 to 400 plants may be put on the waggon and brought to the shed at one time. The drying-shed must be prepared before hand to receive the tobacco. When culti-

vating tobacco on a small scale any shed not in use will answer, provided that it contains a sufficient number of doors and windows to admit of regulating the circulation of air. A roof made of straw seems to answer very well. The shed should be high enough to admit of hanging three rows of tobacco in it one above the other. The bottom tier *for the first row* should be about 3 to 5 feet from the ground according to the size of the plants, which should not touch the ground; the second tier should be 3 to 5 feet higher than the first, and the third 3 to 5 feet higher than the second, the whole being from 10 to 17 feet high from the bottom of the shed to the highest tier. The tiers must be so arranged that the tobacco when hung on the upper tier should not touch that of the lower one, and that the bamboos on which the tobacco has been hung in the field fit exactly. The windows must face each other and be placed between the tiers, so that the bottom part of the window is on the same level as the tier. When cultivating tobacco on a large scale the same arrangements should be made, but the building may be made higher and be provided with a cellar in which to place the tobacco for the purpose of stripping, &c.

63. The tobacco-shed being ready, the plants immediately after they have reached the shed are transferred from the waggon or cart, on the bamboos, to the lowest tier. No rule can be given as to the distance the bamboos should be placed from each other; the distance to be given varies according to the species of the plant, the degree of ripeness, and specially the state of the weather. The purpose of hanging the plant here on the lower tier is to cause the leaves to dry gradually to assume a good yellow color and to cause a slight fermentation in them, but to allow such circulation of the air between the plants as will facilitate the gradual escape of the moisture from the plants and to prevent the injurious development of ammonia and other combinations that give rise to the bad flavor in the tobacco. How to attain this must be left to the judgment of the cultivator; he, by frequent examination of the plants, and by careful observation of the changes going on in the leaves, will soon find out the right way to accomplish it. The best way however would be, especially when he has no experience, to experiment first on a small scale.

Treatment in the drying-shed.

64. The bamboos should be placed close together—

(*a*) When the plants are much wilted on reaching the shed.

(*b*) When the air is very dry and the temperature high.

(*c*) When the leaves of the plant are very thin and contain little water. Certain species have the leaves closely arranged on the stems and others far apart; the plants belonging to the former species must be hung further apart than that of the latter. When the air is very dry and there is a strong breeze, the windows must be closed. If this is not sufficient, water may be poured on some heaps of sand to create a moist atmosphere in the shed. When the stems of the plant are however very thick and consequently contain much sap, it is beneficial to open the windows especially mornings and evenings for some hours that the wind may pass over the but-ends. As the windows are situated above the lowest tier, the leaves will not be much affected by it.

65. The leaves must be examined carefully every day; there may be some plants which dry quickly, others more slowly; one plant may progress very well, whereas another hanging close by decomposes too rapidly, and again another too slowly. Although no change in weather occurs, it may be necessary to alter the position of the bamboos in order that each plant and leaf may receive air in such a degree as is most conducive to its proper decomposition. Any change in the weather necessitates of course different arrangements. The plant should remain on the lower tier until the leaves have turned yellow, which will take place within six to ten days according to circumstances; after this they should be hung on the upper tiers. There they should be hung more apart, each plant hanging free. When hung on the upper tiers, the tobacco may be said to be in the free-hang, and when on the lowest tier in the close-hang. The

Regulation of distance by weather and nature of the different plants.

object in hanging the plant more apart on the upper tier is to dry them then more rapidly and for this purpose the shutters may be opened, unless there be a strong dry wind. The light yellow color of the leaves should change into a dark yellow golden color or light brown. After hanging on the upper tier for about a week, the veins of the leaves will be nearly dry leaving only the mid-ribs pliant. The drying of the leaf and the changing of its color proceeds gradually commencing from the margin and proceeding to the mid-rib. At this time the plants may be hung closer together, the evaporation from the leaves being little, and the space and sticks being required. The plants hanging on two or three sticks may be hung on one stick. All the windows may be kept open from this time; the tobacco may also be brought into an open shed or even hung outside exposed to the sun. In about a week more the mid-ribs will be entirely dried up, and the tobacco fit for stripping.

Drying process from the edge to the centre of the leaf.

66. *Stripping* may be performed at any time, provided the leaves after being once properly dried have again become pliable. For stripping such a number of plants as will furnish work for several days should be taken down on a morning, when the plants have absorbed some moisture and have become elastic; they should be put in a heap and properly covered to check evaporation. If however the night-air should be so very dry that the leaves cannot absorb sufficient moisture to become pliable, then a moist atmosphere can be created either by steam, or by pouring water on the floor, or by keeping chatties with water in the shed. If this cannot be done the tobacco must remain hanging until there is damp weather. Under no condition should the tobacco be stripped when not pliant, that is if the leaves are so brittle that they would break when bent or rolled. The best arrangement is to keep the drying-shed and stripping local separate, since the stripping-room requires to be more moist than the drying-shed. A cellar under the drying-shed would be best suited for stripping. The same should be large enough to admit of the erecting of a scaffold to receive the tobacco.

Conditions necessary.

67. *Sorting.*—Tobacco intended for smoking should be carefully sorted when stripped. There should be four sorts, viz., 1st, large, equally good colored untorn leaves; 2nd, leaves of good size and color but torn; 3rd, leaves of inferior color and bottom leaves, and 4th the refuse containing shrivelled up leaves, &c., to which may be added the suckers. Leaves under No. 1 when thin, elastic and of good species are mostly valued as wrappers (outside covers) for cigars. No. 2 may also be used as wrappers but are less valued than No. 1; they are adapted for fillers and cut tobacco. The different sorts should be kept separate. The best plan is to let the most intelligent man strip the leaves from the stem and at once separate them according to quality. The leaves should then be made into hands, that is 10 to 20 leaves should be tied together by twisting a leaf round the end of the stalks; each sort should be attended by a special man to avoid mixing. The leaves of the first sort being large 10 to 15 leaves will be sufficient for a hand. To make up a hand more leaves are required from the other sorts. When making the hands of the two first sorts the man should take each leaf separately, smoothen the same on a flat board, leave it there and take another leaf treating it in the same way and continue thus until a sufficient number is ready to make a hand. When the hand is ready it should be laid aside, and a weight placed upon it to keep the leaves smooth.

Method of sorting.

68. *Bulking.*—Bulking means placing the tobacco leaves in heaps for the purpose of heating it, in order to attain color and flavor; this is carried out in various ways, nearly all of which involving great labor and risk, as in most instances tobacco loses more or less in value during the process called curing. It must here be mentioned that the more care is taken in raising the crop, the less attention the tobacco requires in the shed. With a good species of tobacco grown on light friable soil, treated as laid down in this paper, and the leaves dried as mentioned above, little care will be needed, after the leaves are dried and stripped. By the drying process described, the leaves will have undergone a slow fermenta-

tion which makes it unnecessary to watch or guide a regular fermentation afterwards, hence bulking and fermenting as generally understood are not required.

69. The tobacco after being made into hands should be put into heaps (bulked) before it again dries. Every evening the tobacco, that has been stripped during the day, should be bulked, but if the weather be very dry, the tobacco must be bulked as soon as a certain number of hands is ready. The heaps should be made from 4 to 8 feet square and from 4 to 8 feet high; all the stalks should be outside, and the whole covered by mats, &c., to check evaporation. The drier the tobacco the larger must the heaps be made to encourage a slight fermentation. The extent of the fermentation can be easily controlled. If the color of the leaves is not uniform or if it is desired to give them a browner color then the heaps must be made large and a somewhat moist atmosphere is required in the storing-room. This will cause fermentation to set in after a short time, and the heat to rise after some days so much that rebulking is required, which is done by putting the top leaves of the old heap at the bottom of the new one. Under such circumstances the heap must be frequently examined during the few first weeks to prevent overheating. It is advisable to rebulk the tobacco also, even when not much heated after the first fourteen days, and again a month later to ascertain the exact state in which it is. Sometimes the tobacco becomes mouldy; this may occur especially with tobacco which has been manured with chlorides, which cause the tobacco to become more hycroscopic than when manured otherwise. If this occurs the mould must be brushed off, and, if necessary, the tobacco dried. The tobacco may now remain heaped in the store-room until there is a chance for sale. It must be remembered however that the best time for sale varies very much. Some tobacco is fit for smoking a few weeks after drying, whereas others burn very badly at that time, but nevertheless sometimes become a good burning article after being stored for several months.

70. It is sometimes the custom to subject the tobacco leaves to some sort of improvement. There is no doubt that by proper application of ingredients the value of tobacco may be much enhanced. The most costly tobacco often commands a high price not so much on account of its inherent flavor as on account of that given to it artificially. In most instances the best course to be adopted is to leave the improvement of the leaves to the manufacturer. Many ingredients are employed to improve smoking tobacco. They tend

1. To make the tobacco more elastic and flexible.
2. To remove the coarse flavor.
3. To add a particular flavor.
4. To improve the burning quality.
5. To improve the color.

To make the tobacco more flexible and pliant the leaves are macerated in, or sprinkled with a solution of sugar. In hot countries this is often necessary to give tobacco such an elasticity as to become fit for handling, especially when intended for wrappers, and may be done by an intelligent cultivator.

71. To remove the coarse flavor, tobacco is often macerated in water or in a solution of Hydrochloric acid. To 100 lb. of tobacco 4 to 8 ounces of Hydrochloric acid diluted with 25 to 30 measures of water is applied in Holland; the more coarse the flavor of the tobacco, the stronger is the solution used. The time of maceration varies between half an hour and an hour. Sometimes tobacco is steeped in a mixture of sugar solution and diluted Hydrochloric acid. To extract the fatty matter tobacco is macerated in alcohol or spirit of wine.

72. To give tobacco a fine flavor numerous substances are employed, some of them are kept secret. In the maceration of tobacco for the purpose of influencing the flavor the following ingredients are mostly in use :—water, muscattee, cognac, vanilla, sugar, rose-wood, nelc-wood, cassia, clove, benzoin, citron oil, rose-wood oil, amber, thyme, lavender, raisins, sassafras-wood, saltpetre, orange, and many others. The burning quality is improved by macerating tobacco in or sprinkling it with a solution of carbonate of potash, acetate of potash, acetate of lime, saltpetre, &c.

Badly burning cigars inserted for a moment in such solutions are much improved. Tobacco treated with acetate of lime yielded a very white ash.

73. The color of tobacco is sometimes improved by fumigating the leaves with sulphur and by the application of ochre and curcuma.

74. Although it may be said that fine tobaccos generally do not require any impregnation with foreign matter for the sake of flavor, yet the manufacturer resorts frequently to it to give the leaf a particular aroma. An inferior tobacco, however, which often would not find a market, is sometimes so much improved by artificial means, as to compete successfully with the genuine fine article.* A special preparation of tobacco for snuff is seldom attempted by the cultivator. With reference to the preparation of tobacco for export the sorting of the leaf is of the utmost importance. Only first and second sorts should be exported. It would be well to remove the mid-ribs whereby the cost of transport and customs duty would be greatly reduced.

75. Finally it must be mentioned that the value of a cigar depends, not only on the intrinsic value of the leaf, but to a great extent on the mode of manufacturing the article. Thus, the raw material may be of good quality, but if the maker does not classify the leaves properly, or, if he rolls his cigars too hard which must vary according to the qualities of the leaves, the cigar will burn badly. The best burning leaves must always be used for wrappers. If this should be neglected the inside of the cigar burns faster than the covering, the air has no access to the burning parts, and the empyreumatical substances are votalized without being decomposed. Such cigars therefore make much smoke and smell badly.

K. SCHIFFMAYER,
Asst. Supt., Government Farms.

SAIDAPET,
7th December 1878.

* It is said that in Germany indigenous tobacco is often so much improved that the cigars made from it after being covered with a fine tobacco leaf are sold as genuine Havannas.

EXTRACTS FROM CORRESPONDENCE.

The following are some of the most interesting letters which have been addressed to the Board of Revenue from this department during the year :—

DAMAGED PADDY CROPS.

I have the honor to report that, in compliance with the instructions conveyed in G.O., F.R. No. 165, of the 21st of January, I proceeded to Trivellore on the morning of the 29th, and spent that day and the next in inspecting the damaged paddy crops that are referred to in Mr. Weld's letter printed with the order quoted.

2. My inspection was confined to the paddy crops growing within three or four miles around Trivellore. Many of these crops were more or less unhealthy, and it was these which had suffered most severely from insect-attacks.

3. The unhealthiness of the paddy plants was, I think, the predisposing cause for the insect-attack, as the plants in a healthy condition have suffered but little from insects. This unhealthiness is, I think, to be attributed to the mismanagement of the irrigation water, combined with the bad physical state of the soil, the effects of the puddling it had undergone. The ryots apparently, believe that the irrigation water now in the tanks will be altogether insufficient to mature their crops when it is used in the ordinary way, and have been reluctant to drain off from the field any water that could be retained under the mistaken notion that they were thereby making it go further. Instead of flooding the field to the depth of 3 or 4 inches, as they are doing, on every third or fourth day, and *keeping the water on the land*, it would be much better if they applied the water more frequently and only in such a quantity at a time as the soil could absorb within a reasonable period. The result of this objectionable practice is that on the low-lying land the water has been allowed to stagnate, the soil being coated with green slimy organic matter and the plants are blackened near the ground.

4. The ryots assert that if they had an abundant supply of water they could effectually deal with this insect-attack, and in this view I partly concur; for by flooding the land and draining off quickly the flood-water, the surface of the soil could be cleansed and renewed vigor would be given to the plants, while most of the surface feeding larvæ would be washed away and drowned.

5. I found that the name "Uru Pucchi" is indiscriminately applied by the ryots to the caterpillars of butterflies and moths, the grubs of beetles, the maggots of two-winged flies, the larvæ of dragon flies, &c. &c. In one place large hairy caterpillars, each of about 2 inches in length, were brought to me, and I was assured most positively that these were the "Uru Pucchi" to which the damage to the paddy crop was to be attributed; at another place the people brought a yellowish green-colored caterpillar, about from 1 to 1½ inches in length, which they asserted were the depredators and the true "Uru Pucchi;" at another place I was shown a large fat, black-colored grub which was asserted to be the "Uru Pucchi." At the least a dozen different kinds of caterpillars, grubs, maggots, and larvæ were produced each as the "Uru Pucchi." None of the ryots that I met knew anything about the metamorphoses of insects, and all asserted that the so-called "Uru Pucchi" existed always in the same form. They appeared quite to disbelieve that the caterpillars, grubs, or maggots found had been hatched from the eggs of butterflies, moths, beetles, or flies. I was therefore quite unable to obtain from the ryots any information by the aid of which the parent insects could be identified.

6. The crops damaged are those under three months old both sown and transplanted, and those that are nearing maturity; the former have suffered the most severely.

7. The plants nearing maturity that were damaged were infested by a maggot called by the ryots "Thal Pucchi;" this was generally found in the culm between the upper node and the ear, but also in some cases lower down the stem. On looking at a crop some plants of

which were thus attacked, the evidence of the injury consisted in the ears having apparently reached maturity long before those of bulk of the crop, which ears on being examined were found to be quite destitute of grain, while they on being taken hold of separated readily from the plant with a few inches of the stem on a very slight strain being applied. On closely examining such plants a puncture mark was generally found in the stem between the upper node and the ear. On carefully splitting the stem we frequently found the eggs of the insect lying inside immediately opposite the puncture mark; in other instances the maggot was found and, nearly always solitary. This maggot is of a light yellow color with a dark-colored head; its length is about ·60 inch. It is, I think, the maggot of a dipterous fly closely allied to the *Chlorops lineata* or the *Cephus pygmæus*, both of which do great injury in Europe, to standing cereal crops, in the way some of the paddy crop has been damaged at Trivellore. In some of the culms we found the pupæ. The female fly apparently deposits its eggs in the stem of the plant where they are hatched and the maggots feed and enter into the pupa state. In some instances we found that the maggot had bored down through the node or joint in the straw, but such instances were exceptional. The effect of the maggot feeding in the straw is, of course, the abortive ear. I fear that but little can be done for the plants attacked by the maggot, but in view to the protection of future crops, it would be well if all the attacked culms could be gathered and burnt; they can be seen at a glance by the appearance of the ears in passing through the field. The damage done by these insects is yet but small, though their depredations are likely to be extended to the other crops as they advance nearer to maturity.

8. The young crops, are suffering chiefly from the effects of stagnant water and bad tillage which have rendered them little able to withstand the effects of the insect-attack. The insects were, I found, chiefly light green-colored caterpillars, about from 1 to 1·50 inches in length and about ·15 inch in breadth; they were, I think, the larvæ of a moth or butterfly. They prey on the blades of the plants chiefly. They can be diminished in numbers in two or three ways. One method followed in some places is to dry the field when the caterpillar falls off the plant, and is afterwards partly destroyed by ants or is washed away by a flood of irrigation water suddenly passed through the field. Another method is to flood the field to as great a depth as possible, then to tread amongst the plants or thrash them lightly with branches or draw over them a log of wood by which means the blades are pushed under water and the caterpillars removed. Other means might be adopted, such as, for instance, to gather off the large caterpillars, to dust the plants when wetted by dew with lime powder, fine ashes or road dust, &c. I do not attribute much importance to the attacks of these caterpillars; I believe that if the plants could but be restored to health by good treatment, the destruction of these caterpillars would not be a serious difficulty.

9. The ryots say that the land, on which the young plants are growing, that are most injured, has lain the longest bare, the result of the absence of the necessary irrigation water last year; and they say that such land has formed the insect nursery in which the insects that are now committing so much damage have been raised, and in this I am inclined to agree with them. Though the land was without the aid of irrigation water, much of it must have been, from its position, frequently in a wet state suited for the growth of coarse semi-aquatic vegetation on which insects would live and multiply.

10. Had there been an abundant supply of irrigation water available, this insect-attack, as regards the young crop, need not have been any cause for anxiety. It is only in connection with the probable deficiency of water that the matter is serious. So far the damage is not great, but I fear the area over which it has occurred is rapidly increasing, and will go on extending unless a heavy fall of rain should occur soon.

11. If, as is generally asserted, the water in the tanks is not nearly enough to bring to maturity the large area of young crop in the neighborhood of Trivellore, it would be well to consider whether it would not be better to take measures to induce the ryots to plough up the worst portions of the young crop and to crop the land with raggi which is apparently not being attacked by insects and which could be matured with one-tenth the quantity of water needed by the paddy plant.

12. The following are the general conclusions and opinions I have formed:—

That, the larvæ of several kinds of insects are preying on the crops.

That, the crops that have suffered most from insects are generally unhealthy.

That, the damage the crops have received is not yet extensive.

That, unless heavy rain occurs soon both partly damaged and, undamaged crops, are likely to suffer severely from these insects.

That, the chief of the causes that are operating to the hurt of the young crop could be controlled, if there was an abundant supply of irrigation water available.

That, if it is found, after proper inquiry, that there is not sufficient irrigation water available for bringing to maturity the whole of the young crop, that inducements should be offered to ryots to plough up the worst of the young crop and substitute for it raggi.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
4th February 1878.

DAMAGED CHOLUM (*Sorghum vulgare*) CROPS.

I have the honor to forward, for the Board's inspection, a few heads of cholum attacked by a blight called "Smut" (*Uredo segetum*), a fungoid disease which appears to be very common this season in this district. It will be observed that the grain is very much changed from its ordinary shape, and that many of the grains are filled with a fine black granular powder (spores).

2. The blight is of common occurrence, but I do not remember any year in which I have seen so much of it as this. In most countries this blight is well known to agriculturists, but it occurs to a serious extent chiefly only in those countries in which agriculture is yet in a backward state. In some parts of England its occurrence is certainly far from unfrequent, but this is only where an antiquated system of agriculture is still pursued, or where injudicious attempts are made to grow cereal crops unsuited to the climatical conditions. However in England, there has been a very marked disappearance of the disease during the past twenty or thirty years which must be attributed to the progressive development of a superior agricultural practice.

3. Straw and grain infested by the spores of "Smut" are not thereby, it is believed, rendered at all injurious when used as the food of livestock, neither is the grain rendered unfit for human food as is that infested by the spores of the fungoid disease called "Ergot." The loss that results from "Smut" is chiefly in the diminution of the yield of grain; and when, as is sometimes the case, from 20 to 30 per cent. of the heads of grain in a field are rendered abortive, the loss is a serious one.

4. It is unknown how the spores find their way to the flowering parts of the plant. It would appear however that the ill-health of the plant is a necessary condition for the full development of the blight. By some, it is supposed that during a low atmospheric pressure the sap passes through the pores of the flowering organs and moistens them with albuminous juices, the food of fungi, and that a high temperature following affords all the conditions required for the functions of the fungi spores present. During the prevalence of the potato disease in a locality, it is observed that the disease is always worst after dense fogs at night and clear bright days. The weather during the past three or four weeks has been exactly of this character, clear bright hot days and dense fogs during the night and the early morning.

5. As regards the prevention of this blight it appears to be generally admitted that superior culture with the protection of the seed by the use of chemical dressings, are the most efficient means. Of course, nothing can effectually protect a field of grain if the crop in a neighboring field or in the locality has been attacked by the blight; hence the attempt to root out the disease in a locality must be general on the part of all the farmers. It was not usual in England until lately to dress seed in view to protect the crop from "Smut," but the practice is now general. It is true that the means taken are not so efficient as could be desired, for the sporules are so liable to become dispersed before harvest and during the harvesting operations. However, it has been shown that when seed infested by the spores of the blight have been sown, the blight has been reproduced in the crop and that when infested seed has been properly dressed with a chemical solution the blight has not appeared. There are many different descriptions of seed preparations used. Those in which sulphate of copper forms the chief or only ingredient are the most to be relied on. The following process might, I think, be adopted with every hope of success in the treatment of seed infested by the spores of the *Uredo segetum* :—

"For 50 lb. of seed take 3 ounces of sulphate of copper which dissolve in one quart of hot water; when the solution is quite cold pour it over the seed, with which mix it thoroughly; when quite dry the seed is fit for sowing."

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
16*th February*.

MANILLA HEMP (*Musa textilis*).

With reference to the latter portion of paragraph 2 of the Board's Proceedings, No. 5,171, of the 6th of December last, I have the honor to submit a copy of a letter to my address from Captain Cox, of Wynad, which affords some useful and interesting information regarding the *Musa textilis*. I have asked Captain Cox for the further information he was good enough to offer to place at my disposal; he is, I believe, at present in England.

2. In this Presidency it is, I fear, only in the country bordering the western coast and on the slopes of some of the higher ranges of hills, that it will be possible to cultivate the *Musa textilis* without irrigation. Elsewhere the rainfall is too scanty and the use of irrigation water would, in most instances, add considerably to the cost of raising the crop. Of course, there are tracts of land so situated that the irrigation water can be applied at a very little cost while good drainage can also be secured, but land so circumstanced is already under profitable culture.

3. The requirements of the *Musa textilis* of the soil and climate appear to be very similar to those of the common plantain. On the Saidapet Experimental Farm, where the water has to be raised about 20 feet and the soil is very poor, it costs, on the average, Rupees 150 per acre to bring into bearing a crop of common plantains, in a period of from 15 to 18 months, the stems of which weigh about 50 tons, the cost per ton thus being about Rupees 3. At Saidapet, however, labor and manure are much more costly than over the Presidency generally, while the soil of the farm is naturally a very poor one and needs heavy manuring. For these reasons the stems might be produced in many places at a somewhat less price than that I have named. I have had no personal experience in cultivating the *Musa textilis*, but, assuming that the account given of the plant and its habits in books regarding the vegetable productions of the Philippine Islands are approximately correct, it may, I think, be estimated that the green stems of the plant could be produced at a price between Rupees 2 and Rupees 3 per ton, over the greater part of this Presidency. Whether, if the stems of the *Musa textilis* could be produced at this price, the fibre could be prepared at a cost to enable it to compete with that of the Philippine Islands, I am unable to offer an opinion; it must be remembered that in some of the provinces of the Philippines, the plants are found growing wild.

4. The *Musa textilis* in the Philippine Islands begins to flower (which is the time for harvesting the stems) when about 18 months' old, but it is probable under such cultivation as that adopted in the treatment of the common plantain, it would reach maturity in less time.

5. The matter is well worth attention, and I hope, with the aid of Captain Cox, we will be able to carry out an experiment in the cultivation of the crop on the Saidapet Experimental Farm.

6. Of the half-dozen shoots of the *Musa textilis* recently received from Calcutta, one only has survived.

7. It would, I think, be better not to get out any machinery for separating the fibre until the cost at which the stems can be produced is determined, though it would be well to institute inquiries regarding the capabilities of the machines said to be adapted for the purpose.

From Captain W. T. H. COX, to W. R. ROBERTSON, Esq., M.R.A.C., *Superintendent of Government Farms, dated 6th August* 1877.

* * * * * *

2. Some years ago I went to some trouble and expense in procuring and starting Manilla Hemp plants, also in procuring information with regard to their cultivation and preparation of the fibre.

3. Messrs. Joney and Co., of Manilla, in the course of a correspondence with them, told me that in the Philippine Islands the plants were simply put in and allowed to grow, no attempt being made at cultivation; that the stems could be cut at two years' old after first planting; that the proper time for cutting was at the commencement of fructification; that in the Philippine Islands the preparation of the fibre was done entirely by hand, the process being so expensive that in some cases the hire of the preparer was one-half of the fibre prepared.

4. It was in the preparation that I failed. I did not care to go to the expense of purchasing machines for making experiments; I however obtained a good deal of information with regard to machines likely to be suitable for the purpose. This information is at your service, and I shall at the same time be happy to give any assistance in my power, in the event of your requiring any machinery. The following is a description of machine which struck me as being likely to answer the purpose: "A cylinder grooved on its periphery revolving with great rapidity against an elastic medium held in contact therewith by a weight which can be accurately adjusted according to the degree of resistance offered by the plant to be treated."

This, with preliminary pressure through rollers, and subsequent washing and drying, has been found to answer well for preparing plantain fibre in the West Indies. I have also descriptions of Sandford and Mallory's and Hodgkins' machines.

5. Dr. Hunter, formerly of Madras, with whom I also corresponded, told me he had tried a great many experiments in cleaning fibres, and had found that there were two points of great importance to be attended to: one being *not to cut more of the plants down than can be cleaned within two days*, for that after two days the fibre lost its silky appearance and also its strength; the second being that *the preparation should all be completed in one day*, as he found that in treating such fibre in the ordinary way by the steeping and rotting processes, putrefaction, instead of fermentation, set in about the third day in hot weather.

6. My experiments certainly agreed with Dr. Hunter's.

7. I have asked the captain of this ship his opinion of Manilla hemp; he tells me that for the rigging of ships he much prefers it to ordinary hemp.

8. It has often been a matter of wonder to me that the Madras Government should so long have neglected the splendid fibres which grow so freely in the Presidency; among these fibres, I imagine that the "*Musa textilis*" would rank first; it grows remarkably well in Wynad.

(True Copy.)

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
26*th January* 1878.

BUCK-WHEAT (*Polygonum fagopyrum*).

I have the honor to submit the following remarks with reference to the suggestions made by Mr. F. G. Shaw, Officiating Inspecting Veterinary Surgeon, in his letter printed with G.O., No. 2,479, of the 10th August last.

2. There can be no doubt but that buck-wheat is suited for culture as an auxiliary bread-corn crop under certain conditions in some portions of this Presidency, but I am of opinion that Mr. Shaw has in his letter greatly overvalued the crop and underestimated the demands it makes on the soil.

3. Buck-wheat has long been known to agriculturists. The crop is cultivated over a wide range of country, but chiefly where the climate is temperate. There are several species, the most important are *Polygonum fagopyrum* (common buck-wheat), *Polygonum Tutaricum* (Tatarian buck-wheat), *Polygonum emarginatum* and *P. cymosum* (perennial buck-wheat). The first of these is the most important and the most generally cultivated. The Tatarian buck-wheat and the *P. emarginatum* are hard varieties, but are less productive while their flour is bitter. The perennial buck-wheat produces, it is said, a large quantity of leaves and branches, but it seeds badly.

4. In Northern India buck-wheat is grown to some extent. In the Punjab it does not appear to be highly valued, judging from the following extract from "The Hand-Book of the Economic Products of the Punjab:" — "The cultivation is confined to the hills and forms an autumn crop; the seeds yield a hard, bitter and unpalatable bread, which is said to be heating; it is only eaten in the plains during the 'bart,' or fast days, being one of the 'phalahas,' food lawful for fast days. There seems to be little or no difference in the taste, &c., of the two varieties, but the appearance is dissimilar, one having sharp edges to the seed, the other being rounded off." The varieties here referred to are *P. fagopyrum* and *P. emarginatum*. Both varieties are grown on the Himalayas at elevations of from 6,000 to 10,000 feet.

5. Buck-wheat (*P. fagopyrum*) is grown, but to a very limited extent, in Great Britain, and, chiefly, only to provide food for poultry or game. On the Continent, especially in Germany, it is extensively grown. Mr. Schiffmayer, my Assistant, who has had some experience in cultivating the crop in Germany, informs me that its usual yield is about 24 bushels per acre, and that the crop occupies the ground from ten to twelve weeks. He adds that, in Germany, it is deemed necessary to secure loose, friable, well-tilled soils for buck-wheat. In America, where the crop is largely grown, it is considered important to secure *fertile* soils for buck-wheat; regarding the crop "Allen's Farm Book," a standard American agricultural work, at page 178, states as follows:—"It grows freely on light soils, but yields a remunerating crop only on those which are fertile. * * * Sandy loams are its favorite soils, especially such as have lain long in pasture, and those should be well ploughed and harrowed."

6. On the Saidapet Experimental Farm, buck-wheat (*P. fagopyrum*) has been tried on two occasions. On the first occasion, about six years ago, a plot of sandy land was sown with Australian seed. It grew to a height of six or seven inches when it flowered, but failed to produce seed. This crop was not irrigated. On the second occasion last year, also with seed imported from Australia, better results were secured from the crop having been occasionally irrigated. The enclosed statement affords full information regarding this experiment. It will be observed that the crop was sown on the 9th November on land in good manural condition; that the crop was watered seven times; and that harvesting did not begin until the 21st of January or ten weeks after sowing, the yield being 167 lb. of grain and 1,138 lb. of straw per acre. In the same field with the buck-wheat, there were plots sown with maize and sorghum which were dealt with in exactly the same way as that under buck-wheat. Both of these crops gave a much higher return; the maize yielding 12,000 lb. of straw per acre. A large area of land sown with yellow cholum without the aid of irrigation gave as much grain and twice as much straw per acre as the buck-wheat. The crops were sown at about the same time, but the cholum occupied the land a little longer than the buck-wheat.

7. The grain of the buck-wheat is undoubtedly a valuable bread-corn. But in estimating its yield of human food it must be remembered that 20 per cent. of the weight of the grain is husk quite indigestible and therefore useless. The decorticated grain is very similar in composition to wheat. The following is an average analysis by Professor Church, M.A. :—

Decorticated Seed of the P. fagopyrum.

	Per cent.
Water ...	13·4
Albuminoids ...	15·2
Starch ...	63·6
Fat ...	3·4
Cellulose ...	2·1
Mineral matters ...	2·3
Total ...	100·0

It thus contains nearly double the quantity of albuminoids and fat; and about 10 per cent. less starch than rice. The grain is very readily converted into flour.

8. There is but a small area of the arable soil of this Presidency that is under present management capable of producing fair crops of maize, yet the buck-wheat demands of the soil quite as much plant-food as does the maize. The following shows the consumption of the more important elements of plant-food by each crop :—

	Per cent. in the ash of Buck-wheat (*P. fagopyrum*).	Per cent. in the ash of Maize.
Potash ...	23·1	27·0
Soda ...	6·2	1·5
Magnesia ...	13·4	14·6
Lime ...	3·3	2·7
Phosphoric Pentoxide ...	48·0	44·4

9. As I have before stated the buck-wheat (*P. fagopyrum*) would form a useful auxiliary corn-crop in some portions of the Presidency where the climate is favorable. The *P. fagopyrum* occupies the ground a little longer than the *P. Tataricum*, which latter is, I believe, the species that Mr. Shaw must have experimented with, though I have met with no other instance of the crop maturing in such a short time as that mentioned by him. But the *P. Tataricum* yields a flour which is bitter and otherwise inferior.

10. We have, I think, several indigenous grain and pulse crops quite equal for ordinary cultivation to the buck-wheat, if only the ryots would be induced to manure and cultivate better.

11. If it is considered desirable to introduce the crop into some parts of the Presidency, the seed could, I think, be obtained in Nepaul, which appears to be the original home of the buck-wheat. I would not recommend the introduction of any species excepting the *P. fagopyrum*.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
8th September 1877.

Experiment made with Buck-wheat in No. 11 Field of the Saidapet Farm.

1.	General nature of soil	Light sandy loam.
2.	Area of land sown	1,302 square yards.
3.	Cultivation of soil before sowing	Ploughed, harrowed, and ridged.
4.	Kind and quantity of manure used ...	Field received a dressing of horse manure. Plot 27 lb. saltpetre.
5.	Per cent. of vital grain in seed	Determined, but record not to be found.
6.	Method of sowing seed	By hand on the ridge.
7.	Pounds of seed sown	(7) seven.
8.	Date of sowing	November 9th, 1876.
9.	Date of appearance of plants above ground.	November 13th, 1876.
10.	Cultivation during growth of crop	Hand-hoed.
11.	Date of plants flowering	About seven weeks after sowing.
12.	If irrigated, how many times?	Seven times.
13.	Number of inches of rainfall and number of wet days during growth of crop.	Inches 3·88. Wet days nine.
14.	Date when crop harvested	January 21st, 1877.
15.	Weight of grain when fit for market ...	45 lb.
16.	Weight of straw when dry	306 lb.

(Signed) C. BENSON, M.R.A.C.,
Superintendent of Saidapet Farm.

SAIDAPET,
5th September 1877.

THE PROCESS OF ENSILAGE.

In reply to the Board's Miscellaneous Proceedings, No. 1,266, of the 5th instant, I have the honor to state that I am of the opinion that no benefit would be likely to result from an experiment in the ensilage of fodder being made at the Saidapet Experimental Farm.

2. The process of ensilage is more especially adapted to moist climates. In this Presidency, excepting in the portions that are subjected to the heaviest rains of the south-west monsoon, we enjoy during ten months in the year great natural advantages for curing green food for storage—advantages which properly utilized would secure far better results than could possibly be obtained from the adoption of the process of ensilage.

3. The ensilage method is not such a new process as Mr. Christy seems to consider it, the process has been carried out in Austro-Hungary since the beginning of the present century and for some years in Spain, France, and Germany. Though in England the process has had some advocates during the past two or three years, it does not appear to have been adopted anywhere to any extent, and its climate is such a moist one that if ensilage of fodder is advantageous anywhere it should be so there. Had the English farmer such natural advantages for curing fodder for future use as we have in this dry hot climate, I am sure he would never adopt the ensilage method.

4. Planters residing in localities where the climate is too moist for the proper curing of green fodder by sun-heat should, I think, have their attention directed to the process of ensilage. I shall be happy to furnish drawings of pits suited for use in very wet climates.

5. Having had no personal experience in curing fodder by the ensilage method, I requested Mr. Kaspar Schiffmayer, Assistant Superintendent of Government Farms, who has had some experience in the matter in Germany, to draw up a memorandum on the subject, a copy of which memorandum I now submit.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
14th February 1878.

MEMORANDUM.

With reference to the storage of green-food in the way described in Mr. Christy's paper, I have to state that in Germany I stored fodder in that manner as far back as the year 1868.

2. The food was first trodden down in tubs and some salt was strewn over it, and the whole was covered with planks on which were laid large stones. The food was kept thus for about six weeks, and when examined it was found to be of a brown color and emitting a rather disagreeable smelling gas. After being mixed with dry chaff the food was given to cattle, which refused it at first but took it readily after two or three days.

3. In Germany at the time referred to the storing of food as described was very much recommended. The merits of the system were considered to be mainly—

(*a*)—It is very well adapted to unfavorable climates where it is difficult and often impossible to make the green food into hay, and also to more favorable climates where the making into hay of the late autumn crops is often very difficult from want of sufficient sun-heat and the occurrence of dews and rains.

(*b*)—The fibre of the plants so prepared becomes more digestible.

(*c*)—The coarse food, such as straw, &c., may be mixed with the prepared food and thus be better utilized.

4. The drawbacks accruing from the process were considered to be—

(*a*)—The uncertainty in securing a *really good* food, a portion of the food being nearly always more or less spoilt; when the pit is very large the food is better preserved, but the necessity of frequently opening it to get out the food causes a considerable proportion of the food to become mouldy.

(*b*)—It is not conducive to the health of the animals fed upon it, especially of cows and young stock; if given to such animals it should only be in the proportion of one part of the pitted food with three parts of other food. Fattening and draught cattle are less apt to be injured.

5. It would appear that the storing of food in pits is advantageous in places where the conversion of green food into hay is impossible or difficult on account of the unsuitability of the climate, but of much less importance in countries with sufficient sun-heat and dry weather to enable the food to be made into hay. Hay-making is usually a very inexpensive process, whereas the pitting system necessitates a great outlay of money and there is always a risk of the food being more or less spoilt, the fermentation is so difficult to control.

SAIDAPET,
9th February 1878.

(Signed) K. SCHIFFMAYER,
Asst. Supt. of Govt. Farms.

THE INTRODUCTION OF STEAM-THRESHING MACHINERY INTO INDIA.

In compliance with G.O., No. 313, of the 27th of February last, I have the honor to submit the following remarks regarding the proposals made by Mr. John Head in his letters, dated the 23rd of November and the 18th of December of last year, printed with the before-mentioned order to introduce steam-threshing machinery into India, in view to the further development of the export trade in wheat.

2. Mr. Head proposes to introduce steam-threshing machinery *for threshing wheat only*. European-threshing machines being specially constructed for threshing this and other corn crops of Europe, this proposal is not open to the objections raised hitherto in this country against the introduction of English-threshing machinery; for until now such proposals have always contemplated the threshing of our *ordinary* grain crops by these machines, for which purpose, as now constructed, they are quite unfitted. No more difficulties would be likely to be experienced in threshing by machinery a crop of Indian-grown wheat than in threshing by similar means a crop of wheat raised in England.

3. However, the adaptability of threshing machines for threshing crops of Indian wheat is not the only point to be considered; there are other questions of equal importance that require to be answered; amongst these, the following:—

(1) Will it be possible to move the threshing machinery from village to village under existing circumstances?

(2) Can our agriculture afford to lose 10 per cent. of the straw of the wheat crop?

(3) Would steam-driven threshing machinery be likely in the rural districts to perform the work needed at a less expense than the ryot now incurs?

4. I will endeavor to answer these questions from such information as I possess regarding the condition and circumstances under which agriculture is practised in this Presidency. I do not apprehend that there is any material difference between the state of matters of this nature in this Presidency and in other parts of India in which wheat is more extensively cultivated. I may observe here, however, that wheat is grown to a very limited extent in this Presidency; in an average year it occupies only about 19,000 acres of the 21,000,000 acres cropped, and it is met with only in small plots scattered over a considerable area of country.

5. *Will it be possible to move the threshing machinery from village to village under existing circumstances?*—The weight of the threshing machine and engine it is proposed to employ would be between nine and ten tons. Mr. Head says that on an ordinary road two to three pairs of bullocks would draw each machine.* It is presumed that he refers to the draught bullocks usually employed in Europe, the live weight of which on the average is certainly five times as great as that of the ordinary draught bullocks of this country; assuming that this is so, and that the draught power of cattle bears a close relation to their weight, it follows that from twenty to thirty, or say twenty-five pairs of bullocks would be needed to draw the machinery. But Mr. Head refers to an *ordinary* road. In this Presidency, except in the main lines of traffic and in and around the chief towns, the roads cannot be deemed *ordinary* roads in the sense understood by Mr. Head, and this Presidency is perhaps as well off as regards good roads as any other part of British India. There would perhaps be no difficulty in drawing the machinery along these main roads; but they have generally been constructed in view to secure the shortest and best line between places of importance and not with special regard to the wants of the country through which they pass; hence it but seldom happens that any but the largest villages and towns are approached by these roads. In many parts of the country the villages are frequently situated miles away from these roads, between which and these villages there is frequently nothing more than tracks fit for pack animals and pedestrians. Metalled secondary roads are met with in the more thickly-populated parts of the country, but more frequently these secondary roads consist of nothing more than a cart-track, the line of which is seldom fixed with any degree of permanence. Along these roads it is difficult to drive any vehicle other than an ordinary native cart; and at certain seasons and in certain parts of the country it is difficult to get even these carts along the roads when moderately loaded. It would thus appear to be impracticable to move the threshing machinery from village to village except by incurring an enormous expenditure; and that, if these machines were introduced, they should be drawn along the principal metalled roads only. This would involve the selection of centres along these lines of roads to which the unthreshed grain could be brought and the threshing operations performed. In some localities the position of these roads might be convenient for the foregoing arrangement, but I fear generally the arrangement would necessitate long cartages and frequently over very bad roads which would be likely to prevent ryots from bringing their produce to these threshing centres.

* One engine and one threshing machine.

6. *Can our agriculture afford to lose* 10 *per cent. of the straw of the wheat crop?*—In almost all parts of India there is during several months in the year a great dearth of cattle food. The great want of India is *more stock* and *better fed stock*. It is true that straw is but a poor food, yet it nevertheless forms the chief food of the draught cattle of this country, and will continue to do so until the ryot can be induced to grow fodder crops. If agriculture was practised as it ought to be, the loss of 10 per cent. of the wheat straw by its use as fuel would not be a matter of any moment, for it would be so easy to replace the loss by raising fodder crops or by better tillage and manuring to make the crops yield 10 per cent. more of straw. Assuming that there would be no special effort to make up the loss of the straw that would be used as fuel, it becomes necessary to determine what this loss would amount to. It appears that to raise steam in one of the straw-burning engines 25 lb. of straw per horse-power per hour is consumed. In other words, for an engine of the size mentioned by Mr. Head, about one ton of straw would be consumed per working day or 100 tons in a working season of five months. This is not a great quantity of straw to lose for each engine employed, seeing that such a considerable quantity would be threshed in the period mentioned; indeed, it is more than probable that in threshing out the same quantity by means of cattle in the usual way they would consume a larger quantity than the engine, but the straw consumed by the engine is so much dead loss as regards the providing of food for the stock of the country. It is true that wheat straw is not generally much appreciated by ryots as fodder, but their necessities are often great, and at such times they are glad to get anything that will but keep their stock alive. In most parts of India straw is a much esteemed produce and frequently is sold at very high prices, indeed quite as high as in England. It is but rare, indeed, in this country that straw is looked upon as a refuse to be got rid of by any means, as apparently was the case in so many parts of Southern Russia at the time when the straw-burning engine was introduced there. The engines could use as fuel vegetable refuse not adapted for use in feeding stock, but in India fuel is frequently as scarce as fodder, and in most parts every particle of vegetable refuse is carefully collected for use as fuel. On the whole, however, I am of the opinion that the loss of the straw that would be used by the straw-burning engines would not be a matter of serious importance.

7. *Would steam-driven threshing machinery be likely in the rural districts to perform the work needed at a less expense than the ryot now incurs?*—Each set of machinery Mr. Head proposes to introduce would cost, it appears, about 9,000 Rupees delivered in this country, that is, if the threshing machine is made of teak and the usual spare wearing parts are supplied. It is difficult to determine the number of days in the year on which the machine would probably be at work, so much depends upon the part of the country in which it is employed: Usually

the cultivators thresh their grain crops very soon after harvest. In this Presidency crops are very rarely stacked unthreshed. Over considerable tracts of country heavy rains are due soon after the harvest season. In the absence of proper arrangements for stacking or storing under cover unthreshed crops, the threshing season must necessarily be usually a very short one. Heavy rain would prove highly detrimental to unthreshed wheat stored in the usual careless way. All things considered, then, I am of the opinion that unless ryots can be induced to stack their unthreshed wheat in properly built stacks into which the rain cannot readily find access, or to store it under cover, the threshing season over the country generally could not be made to extend over five months in the year, or the machine would actually do a day's work only during 100 days in the year, and even this would only be when the distances to be travelled by the machine are short and the state of the roads generally good. If then the threshing season will consist of only 100 actual working days in the year, it will be necessary to divide over these days the interest on the capital employed and the annual charge for wear and tear. Taking these together at 15 per cent. per annum, this charge will amount to Rupees 1,350 or Rupees 13-8-0 per working day.

8. The next point to investigate is the cost of fuel. In most parts of India, fuel is much more costly than in England; in Madras the ordinary price of Casuarina firewood is Rupees 8 per ton; estimating that 3½ tons of Casuarina wood is equal for raising steam to one ton of coals, we have Rupees 28 as the cost of producing by wood the amount and force of steam that would be generated by the consumption of one ton of coals; the ordinary selling price of which at the coast in this Presidency varies from Rupees 25 to 35 per ton, a price about *five times as great as that at which the English farmer generally can buy coals for use in raising steam.* It is true that Mr. Head proposes to use neither coals nor wood for raising steam in the engines to be employed; however the price of wood regulates the market price of all other descriptions of fuel, and it would not be less costly probably to use either straw or other vegetable refuse. Valuing coals at Rupees 30 per ton, and assuming that the effective power of straw as fuel in raising steam is one-fifth of that of a similar weight of coals, it follows that the full value of straw would be only Rupees 6 per ton, a price at which in this Presidency ryots would but seldom be willing to dispose of their straw. However, for my present purpose, I will value the straw, or other vegetable refuse, to be used as fuel, at Rupees 6 per ton. As one ton of straw would be used per day the cost would be Rupees 6 per day for fuel.

9. The next item of cost to be determined is *labor*. Mr. Head says that a competent mechanic to take charge of each machine would expect £20 per month with board and lodging and his passage paid out and home; the entire cost for the wages, &c., of such a man would be, say, Rupees 300 per mensem. Assuming that he could be profitably employed during the seven months of the year when not employed in threshing, his cost during five months, Rupees 1,500, would have to be charged over 100 working days, making the charge for this man's services Rupees 15 per day. The other labor would be ordinary cooly labor, and for this the daily cost for each working day would not be more than Rupees 3.

10. I have now to determine the cost of moving the machinery from place to place, an item very difficult to arrive at. Assuming that the machinery is placed in a large wheat-producing country and that convenient centres can be arranged for threshing necessitating the removal of the machinery, say, ten miles at intervals of five days, there would be thirty removals in the season of five months; and if twenty-five pairs of cattle are sufficient for removing the machinery, the services of 750 pairs of cattle would be required for one day, the hire of which at 8 Annas per pair with driver would represent Rupees 375, which divided over 100 working days would amount to per day a little less than 4 Rupees.

11. The foregoing may be summarised as follows:—

	Cost per Working Day. RS.	A.	P.
Interest on Capital and wear and tear on Rupees 9,000 at 15 per cent. per annum, charged over 100 working days ...	13	8	0
Cost of fuel	6	0	0
Cost of labor	18	0	0
Cost of removals	4	0	0
Total ...	41	8	0

The total cost would thus amount to Rupees 41-8-0 per working day. Mr. Head estimates that each machine would thresh and clean for market 500 bushels of wheat per working day. According to the foregoing figures, then, the cost of threshing each bushel of wheat would be Rupees 0-1-4.

12. In this Presidency agricultural labor is generally paid in kind. For threshing and winnowing wheat the rates paid vary; the average rate is probably something near 7½ per cent. of the grain threshed, but this is for Spelt wheat; common wheat is not grown to any extent in this Presidency. Thus for threshing and winnowing a bushel of this wheat weighing

55 lb. the payment would be 4 lb. or, valuing the bushel at Rupees 1-8-0, the money-value of the grain paid, would be Rupees 0-1-9. For threshing and winnowing a bushel of common wheat the cost would be about the same. However, if the labor was properly regulated, and the winnowing machine was used, the cost of the work might, I believe, be considerably reduced. Thus, for instance, for threshing and winnowing paddy it is usual for the ryot to pay 5 per cent. of the grain threshed, which would be 2½ lb. of grain for threshing a bushel weighing 50 lb. or valuing the bushel at 1 Rupee, the grain paid for threshing it, would be worth about three-quarters of an anna. On the Saidapet Experimental Farm the cost is even less, from the employment there of winnowing machines in preparing paddy for the market. A few days ago, at that farm, the crop produced on 2 acres of land, consisting of 14,464 lb. of straw and 3,200 lb., or about 64 bushels of paddy, was threshed and winnowed in one day by six men, whose wages together amounted to 1 Rupee; in this case, *the cost was only quarter of an anna per bushel.*

13. Mr. Head asserts that the threshing machine will remove from 10 to 15 per cent. of the grain which, he says, is left in the straw when threshed in the ordinary way. It is true that there is often a good deal of waste when the grain is threshed out by the treading of cattle; but there is no reason why the flail should not be used instead, and this will get out the grain almost as effectually as the threshing machine can. But with some of our grains, paddy for instance, threshing is perfectly performed by merely raising the sheaf of unthreshed grain and striking the ear-end five or six blows on a log of wood.

14. On the whole I am of the opinion that at present there is but a very limited field in this country for the employment of steam-threshing machinery, and that, before attempting to introduce steam-threshing machinery, excepting where circumstances are specially favorable to its working, it would be much better to endeavor to induce the ryots to improve their present system of threshing and preparing grain for the market, especially do I think it necessary that they should be advised to use winnowing machines. From the resolution of the Government of India and the papers to which it refers "on the development of the export trade in Indian wheat," it would appear that the most serious objections made in England to Indian wheat are (1) that it is usually in a very dirty condition; (2) that it is generally very mixed, the sample being formed of several kinds and qualities of wheat; (3) that it is generally mixed with pulses and, frequently with other kinds of grain. I need scarcely say that the use of the threshing machine would not remove these objections; it is true that cleaning or sizing machinery, that is, winnowing or screening machines, could be combined with the threshing machine; but they could equally well be used by themselves, and be driven either by manual or cattle power. Such machines would remove the dirt, and they would improve the sample by taking from it all light and inferior grain; but they could not, except to a very limited extent, remove the pulses, and they could do nothing towards separating wheats of different qualities when the grains are similar in size. This last drawback can be remedied only by the selection and sowing of proper seed and the avoidance of sowing pulses with wheat. I am inclined to believe that it is to an improvement in our agricultural practice, rather than, to the introduction of steam-threshing machinery, that we must look, to place the export trade in Indian wheat on a sound footing.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
30th March 1878.

DISTRIBUTION OF SEED-GRAIN TO RYOTS DURING THE FAMINE PERIOD.

I have the honor to direct attention to the necessity there is for some exact inquiries being instituted in the districts at once regarding the quantity and quality of agricultural seeds available, for seeding the land to be cropped during the north-east monsoon.

2. The unirrigated land watered by the north-east rains is sown in August, September, and October with seed harvested in the previous January or February. But as on nearly the whole of the land watered by this monsoon *there was no harvest in the present year,* or only to a very limited extent and of inferior produce, the seed available will therefore in most cases be either inferior fresh seed, or old seed of the harvest in the early part of 1876. The bulk of the seed will thus be from 18 to 20 months old at the next sowing season, instead of only 6 or 8 months old.

3. The time during which seed will retain its vitality varies greatly, dependent on the state of maturity when harvested, the care with which it was stored, the species of plant to which it belongs, &c. &c. When field seeds are harvested under right conditions and when extraordinary care is taken in storing them and in treating them during storage most kinds

would be little, if at all, injured in their plant-producing capabilities after being kept for a period of, say, 20 months. But when the seed has been harvested under unsatisfactory conditions and is put aside without any regard to preservation beyond protection from insects, the probability would be that the bulk of it after 20 months would be unable to produce healthy plants.

4. In order to avoid the loss of human food that would result next cultivating season from the sowing of bad seed, it would be well, I think, if after investigation the facts are found to be as I have indicated, to institute measures for placing good seed within the reach of all ryots who require it. There would, of course, be a considerable area of country in which such assistance would probably not be required from good seed being available.

5. The seed could not be supplied gratuitously, for the cost of the seed in the area of country influenced by the drought would exceed the entire annual revenue from the land in the shape of rent; however, seed depôts might be established, the working charges to be met by Government, the seed to be sold to the ryot at the cost price, payable in two instalments in a period of two years; ryots only to be permitted to make purchases, and no ryot to be allowed to purchase a quantity greater than would sow three-fourths of the land for which he holds a putta.

6. As to the localities in which the seed should be obtained, it would be necessary to institute some careful inquiries. It would scarcely be safe to import seed to any extent from Bengal, but perhaps the Central Provinces might afford a supply; and there are portions of this Presidency in which the last south-west monsoon did not utterly fail, from which good seed might be procurable. It is not wise, as a general rule, to use for dry cultivation seed that has been produced under well-irrigation, or an abundance of seed so raised in this Presidency might be obtained.

7. The present unfortunate condition of agriculture as regards the supply of seed might if properly turned to account result in much good. In all civilized countries the advantages that result from a change of seed are fully recognized. But in this country unfortunately ryots go on from generation to generation sowing seed, the produce of the previous harvest, either on the same or neighboring land.

8. The two districts, Bellary and Cuddapah, which have been the most severely influenced by the drought, produce, as far as my experience goes, the finest samples of dry grains to be met with in this Presidency. But unfortunately the produce of these districts will not be available to any extent; however, some seed may be available for purchase in parts of both districts which would otherwise be used as food.

9. I fear that now but little could be done towards making good seed available in the portions of the country watered by the south-west rains, still some effort should be made in this direction.

10. It is surprising in going through the country what a difference there is in the character of agricultural produce on land situated only a few miles apart. The distribution of the good seed in the localities where only inferior seed is usually sown would do much to raise the character of the produce and result in producing a somewhat greater uniformity in the character of our agricultural produce, a point of considerable importance as regards that portion which is exported.

11. The Government Grain Agency with some slight modifications in its constitution might take charge of the distribution of seed. There would be no interference with trade if these proposals were carried out, for at present no trade in this country has anything to do with the supply of seed to the farmer.

12. I forward a copy of the Journal of the Royal Agricultural Society of England in which, at pages 325 to 352 inclusive, will be found an account of the distribution of seed to French peasant farmers after the close of the Franco-German War, which may afford some hints.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

SAIDAPET,
5th June 1877.

APPENDICES.

APPENDICES

TO

THE SYDAPET EXPERIMENTAL FARM REPORT.

APPENDIX I.

Letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of the Government Farms, to H. E. STOKES, Esq., Secretary to the Board of Revenue, dated Sydapet, 8th December 1877, No. 1,038 :—

The facts disclosed in the accompanying letter and statement are of great interest. I have long been aware that during the south-west rains there was frequently a considerable difference in a day's rainfall as registered at Sydapet and at the Observatory ; but I did not know that there were any important differences in the registrations at the two stations during the north-east rains. I may add that the Sydapet rainfall is registered personally by Mr. Benson.

2. The distance between the two stations is, I think, not more than five miles. Though the annual fall has differed but little, there has been a considerable difference both in the daily and the weekly registrations.

ENCLOSURE No. 1.

From C. BENSON, Esq., M.R.A.C., Superintendent of the Sydapet Farm, to W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of the Government Farms, dated 7th December 1877, No. 57-B.

I have the honor to submit, herewith, a statement of the rainfall registered here during the past three months of September, October, and November. It is remarkable that when compared with that registered at the Observatory as a total there is very little variance, but taken week by week the differences are often very great. It must be remembered in looking at the tables that I have always registered the rainfall at 9 A.M., whilst at the Observatory it is recorded at midnight ; this difference in the time of observation would cause, perhaps, differences in the daily totals, but not in the weekly ones.

2. During the whole of October and up to the 7th November the extremely local character of the rains is clearly shown, and at no time more so than in regard to the falls at the end of the former month, when, for instance, we in the four days, 28th, 29th, 30th and 31st, registered 8·18 inches compared with only 5·52 inches at the Observatory. The deceptive character of a season such as this does not need comment, for it must be self-evident that the records of a few gauges scattered over the country at great intervals cannot be taken as a guide to the general pluvial conditions of it. Happily, however, since 8th November we have had far more general rains, and although this has come exceedingly late in the season, and has thus kept all agricultural operations backward, if it be followed by late rains during this present month, the crops will not suffer much.

(True Copy.)

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms.

ENCLOSURE No. 2.

Table showing the Rainfall registered at the Sydapet Experimental Farm compared with that at the Observatory.

Date.	Sydapet Farm, 1876.	Observatory, 1876.	Sydapet Farm, 1877.	Observatory, 1877.	Date.	Sydapet Farm, 1876.	Observatory, 1876.	Sydapet Farm, 1877.	Observatory, 1877.
1st September ...	...	0·06	0·06	...	18th October ...	...	0·02	...	0·01
2nd „ ...	...	0·01	...	0·19	19th „ ...	...	...	...	...
3rd „ ...	...	0·16	...	...	20th „ ...	...	...	0·15	...
4th „ ...	0·57	0·91	...	1·03	21st „ ...	...	...	...	...
5th „ ...	1·24	0·24	1·60	0·06	22nd „ ...	...	...	0·16	...
6th „ ...	...	...	0·22	0·63	23rd „ ...	...	...	...	0·94
7th „ ...	...	...	1·76	0·13	24th „ ...	...	...	...	0·02
8th „ ...	...	...	0·09	...	25th „ ...	...	...	0·16	0·63
9th „ ...	...	...	0·25	0·13	26th „ ...	...	...	0·05	0·02
10th „ ...	...	...	...	...	27th „ ...	0·30	0·36	0·16	...
11th „ ...	0·01	...	...	0·35	28th „ ...	0·15	...	0·35	0·47
12th „ ...	...	...	...	...	29th „ ...	...	...	1·01	3·52
13th „ ...	...	...	...	..	30th „ ...	...	...	6·47	1·46
14th „ ...	...	...	...	...	31st „ ...	...	...	0·35	0·07
15th „ ...	...	...	...	...	1st November ...	...	...	...	4·80
16th „ ...	...	...	...	...	2nd „ ...	...	...	0·63	0·25
17th „ ...	...	...	...	...	3rd „ ...	...	...	0·14	0·01
18th „ ...	...	...	...	...	4th „ ...	...	...	...	0·01
19th „ ...	...	...	...	...	5th „ ...	...	...	...	0·06
20th „ ...	...	...	...	0·04	6th „ ...	...	...	0·08	...
21st „ ...	...	...	...	...	7th „ ...	...	...	...	0·03
22nd „ ...	...	...	...	...	8th „ ...	...	...	1·20	0·55
23rd „ ...	...	0·03	...	...	9th „ ...	0·12	0·43	1·87	2·53
24th „ ...	...	0·52	0·92	0·38	10th „ ...	1·04	2·30	2·75	2·60
25th „ ...	...	1·10	...	...	11th „ ...	1·01	...	...	0·06
26th „ ...	0·28	...	...	0·11	12th „ ...	0·02	...	...	...
27th „ ...	...	...	0·65	...	13th „ ...	...	...	...	0·86
28th „ ...	...	...	0·30	0·05	14th „ ...	...	...	1·95	0·54
29th „ ...	...	...	...	0·01	15th „ ...	...	...	4·77	5·30
30th „ ...	...	0·23	0·07	0·04	16th „ ...	...	...	1·75	1·75
1st October ...	1·34	...	...	...	17th „ ...	...	...	0·90	1·64
2nd „ ...	...	...	...	...	18th „ ...	...	...	0·78	0·14
3rd „ ...	...	...	0·15	...	19th „ ...	...	...	0·35	...
4th „ ...	...	...	...	0·87	20th „ ...	...	...	...	...
5th „ ...	...	...	0·66	...	21st „ ...	...	...	...	...
6th „ ...	...	...	...	...	22nd „ ...	...	...	...	...
7th „ ...	1·01	0·59	...	...	23rd „ ...	...	...	...	...
8th „ ...	...	...	...	...	24th „ ...	...	...	...	...
9th „ ...	...	...	...	...	25th „ ...	...	...	...	...
10th „ ...	...	...	...	...	26th „ ...	...	...	...	...
11th „ ...	...	0·04	...	0·32	27th „ ...	...	...	...	...
12th „ ...	...	0·01	...	...	28th „ ...	...	...	0·03	...
13th „ ...	...	...	...	0·21	29th „ ...	0·85	1·27	...	...
14th „ ...	...	...	0·20	...	30th „ ...	0·70	0·20	...	0·12
15th „ ...	...	...	...	0·01					
16th „ ...	...	...	...	...	Total ...	9·18	8·50	32·99	32·96
17th „ ...	0·54	0·02	...	0·01					

(Signed) C. BENSON,
Superintendent.

Table showing the Rainfall registered at the Sydapet Experimental Farm compared with that at the Observatory Weekly.

Number of Week.	Sydapet Farm, 1876.	Observatory, 1876.	Sydapet Farm, 1877.	Observatory, 1877.	Number of Week.	Sydapet Farm, 1876.	Observatory, 1876.	Sydapet Farm, 1877.	Observatory, 1877.
First Week, 7th Sept.	1·81	1·38	3·64	2·04	Ninth Week, 2nd Nov.	0·45	0·36	8·97	10·57
Second „ 14th „ ...	0·01	...	0·34	0·48	Tenth „ 9th „ ...	0·12	0·43	3·29	3·19
Third „ 21st „ ...	...	...	...	0·04	Eleventh „ 16th „ ...	2·07	2·30	11·22	11·11
Fourth „ 28th „ ...	·28	1·65	1·87	0·54	Twelfth „ 23rd „ ...	...	...	2·03	1·78
Fifth „ 5th Oct.	1·34	0·23	0·88	0·92	Thirteenth „ 30th „ ...	1·55	1·47	0·03	0·12
Sixth „ 12th „ ...	1·01	0·64	...	0·32					
Seventh „ 19th „ ...	0·54	0·04	0·20	0·24	Total ...	9·18	8·50	32·99	32·96
Eighth „ 26th „ ...	...	...	0·52	1·61					

(Signed) C. BENSON,
Superintendent.

APPENDIX II.

Valuation of the Sydapet Farm and Estate on the 31st of March 1878 compared with that made on the 31st March 1877.

	Value of Stock on the 31st March 1877.			Increase in the Year.			Decrease in the Year.			Value of Stock on the 31st March 1878.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
ESTATE—												
Land	35,880	0	0	1,600	0	0	.....			37,480	0	0
Buildings	19,800	0	0	1,950	0	0	.....			*21,750	0	0
Wells and Channels	3,600	0	0	3,400	0	0	.....			7,000	0	0
Fruit and Fuel trees	4,705	0	0	860	0	0	.....			5,565	0	0
FARM—												
Live Stock—												
Cattle	3,980	0	0	.....			1,330	0	0	2,650	0	0
Sheep	1,380	0	0	.....			95	0	0	1,285	0	0
Pigs	100	0	0	.....			100	0	0	.....		
Poultry	171	0	0	.....			81	0	0	90	0	0
Dead Stock—												
Grains, &c.	494	9	0	119	7	0	.....			614	0	0
Manures	553	8	0	.....			243	8	0	310	0	0
Implements	6,617	13	0	.....			191	15	0	6,425	14	0
Growing crops	672	12	0	247	4	0	.....			920	0	0
Total ...	77,954	10	0	8,176	11	0	2,041	7	0	84,089	14	0

* This does not include the students' quarters erected on the farm.

APPENDIX

TO

THE GENERAL REPORT.

DETAILED STATEMENT OF THE ACCOUNTS OF THE MADRAS AGRICULTURAL DEPARTMENT.

Expenditure.

	Rs.	A.	P.	Rs.	A.	P.
I. General Supervision—						
Establishment	18,704	10	11			
Travelling allowance	28	14	3			
Contingencies	518	1	2	19,251	10	4
II. Saidapet Experimental Farm—						
Establishment	2,189	0	7			
Cooly labor	3,840	7	11			
Implements and machines	1,187	4	0			
Live stock	256	14	0			
Seeds	370	5	11			
Food for live stock	2,294	15	1			
Manures	426	6	10			
Despatching seeds	191	8	3			
Contingencies	238	7	9	10,995	6	4
III. Implement Workshops—						
Carpenters, Smiths and Filer	858	5	3			
Cooly labor	203	4	6			
Materials, machines and implements	969	0	8	2,030	10	5
IV. Educational (School of Agriculture)—						
Twenty-four Stipendiary Students	3,600	0	0			
Establishment	3,613	5	0			
Draftsman's pay	141	0	9			
Books, Stationery, &c.	124	0	0			
College accommodation	1,427	10	6			
Lecture fees	5,040	0	0			
Students' cottages	3,498	14	5			
Cook houses	942	5	2			
Contingencies	1,026	3	4	19,413	7	2
V. Estate Improvements—						
Repairs to buildings	1,392	13	7			
Permanent Improvements—						
Vide G.O., No. 2,009, dated 28th December 1876, Rs. 1,750						
,, ,, ,, 1,376 ,, 9th April 1877 ,, 2,400	6,074	6	6			
,, ,, ,, 2,567-A ,, 24th August ,, ,, 1,600						
,, ,, ,, 2,654 ,, 6th September 1877 ,, 253						
Trees and planting	220	11	2			
Manufacture of drain-pipes and sub-soil drainage	502	2	3			
Brick and mortar bridges under main roads	164	8	11			
Construction of implement sheds Do. of cartshed and cook-house	422	11	9			
Boundary wall near Farm buildings	40	10	6			
Contingencies	68	2	0			
Compensation to Wudders	270	0	0			
Extension to Superintendent's Bungalow	1,200	1	9	10,356	4	5
VI. Other charges—						
Allowance to Surgeon paid by the Saidapet Treasury Deputy Collector	361	10	8	361	10	8
Paid value of, and freight on certain Text Books by transfer.	403	13	10			
Paid Presidency Medical Stores Department for medicines supplied by transfer	98	14	3	502	12	1
				62,911	13	5

Income.	Rs.	A.	P.	Rs.	A.	P.
Adjusted balance at the beginning of the year	2,56,331	9	1			
Provincial Grant	20,000	0	0			
Receipts from the Surplus Pound Fund during 1877-78	38,205	8	2			
				3,14,537	1	3
Saidapet Experimental Farm—						
Fruits, vegetables, fodder, &c.	477	15	5			
Rent, &c.	294	6	4			
Live stock	335	12	0			
Grains and cattle food	620	7	9			
Machines	43	3	7			
Cotton	37	14	0			
Indigo	191	15	8			
Sundries	351	0	9			
	2,352	11	6			
Implement Workshops	1,850	13	8	4,203	9	2
				3,18,740	10	5
Balance in favor of the Department on the 1st of April 1878.	2,55,828	13	0			

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms.

14th August 1878.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ THE FOLLOWING PAPERS:—

Proceedings of the Board of Revenue, dated 21st February 1879, No. 472.

THE report on the Saidapet Farm and that on the School of Agriculture were submitted* in August and September last, and Mr. Robertson now forwards the complete report of "the Agricultural Department."

* Board's Miscellaneous Nos. 9,690 and 10,270, dated 19th Sept. and 5th Oct. 1878.

2. This forms a volume of 156 pages, of which only 40 are occupied with the account of the year's operations on the Farm at Saidapet, while the rest is made up of the report on the School of Agriculture, of papers on various agricultural topics, of extracts from correspondence, and a paper on agricultural education in Germany and Austria.

3. These are all interesting and instructive, but much of the matter contained therein is already on record—sometimes in the very form in which it now stands,—and the Board do not consider that its republication along with the Farm Report. serves any useful purpose.

4. The latter, they think, should be complete in itself, and the report on the School of Agriculture might, they would suggest, be not only included as at present in the report of the Director of Public Instruction, but be also separately reviewed as is done in the case of the report of the Medical College.

5. The Manual of the Government Farms now in the Press contains full information on such subjects as manuring, rotation of crops and irrigation, and its appearance will render unnecessary the publication of separate papers on such subjects, while special reports are more likely to be duly considered, if published and distributed alone from time to time.

6. Mr. Robertson states that the instructions of Government as to the preparation of the report on the Saidapet Farm did not reach him in time to enable them to be followed in regard to this report which is therefore in its old form, but that the further information desired by Government is made the subject of a separate communication.

7. SEASON.—The rainfall at Saidapet in 1877-78 was abundant but peculiar.

8. The drought of the previous year continued until the middle of May when the cyclone storm, during which as much as "16·55 inches fell in a little over twenty-four hours," did much damage to the land and standing crops.

9. Subsequently the rainfall was deficient until September, but the good rains of that month were followed by dry weather until the end of October. November was a wet month, but December less so than usual, and, with the exception of a slight fall in January, there was no more rain during the year.

10. The crops suffered to some extent from locusts, and a green caterpillar which attacked the young paddy was particularly troublesome.

11. Fungoid diseases, more especially "rust," which attacked the sorghum crops, were prevalent.

12. In regard to "labor" the Superintendent remarks that the physical condition of the coolies "notwithstanding their regular employment became so reduced during the year that it was impossible to obtain full work from them," but he does

not state what rate of wages was paid, and whether it was higher than in ordinary years so as to preserve some proportion with the rise in the prices of food-grains.

13. CULTIVATION.—In the report for 1876-77 a special rotation of crops was recommended, and it is now stated that it is proposed to test it by actual experiment during the next five years. The beneficial effects of deep cultivation particularly in times of drought are adverted to as having been still further established since last year, and the necessity of manure, if these results are to be maintained, is strongly urged.

14. In the report on his tour in Coimbatore, Mr. Robertson spoke (paragraph 119) with approval of a method of stirring the soil with crowbars adopted in some cases by the cultivators in that district, and it is interesting to note that this method was tried on the Farm with very favorable results in the case of a field which had previously "become totally inimical to the growth of plants."

15. UNIRRIGATED CROPS.—Tables are given exhibiting the results obtained with different crops on dry and wet lands, and in the case of the former it is shown how small a rainfall is sufficient for ordinary crops when the land is properly manured and cultivated.

16. From the statement in which the cost of production is given it would appear that as a rule a fair profit was realized, but though the items into which the expenditure is divided are given, no information is afforded as to the method of calculation adopted, nor as to what is meant by "manure chargeable to the crop."

17. IRRIGATED CROPS.—The wet lands were irrigated partly from the Mylapore tank, partly by water raised by picottahs from the Adyar, and partly from wells. The latter were apparently used mainly to secure a constant supply of fodder for stock, and it is calculated that allowing each "20 lb. of forage per diem" four head of cattle might be maintained for a period of three months by the produce of every acre irrigated.

18. This is taking 8,000 lb. as an average yield per acre, but it is observed that the crops which produced most heavily benefited by the heavy rains of May 1877 and were by no means entirely dependent on water artificially supplied.

19. The crop planted after the fall gave a very indifferent return or less than half that taken as the average yield. Attention is called to the fact that the field which yielded best under paddy had "adequate drainage."

20. The Farm officers are of opinion that their irrigated crops are grown and harvested in less time than those of native cultivators. They attribute this result to "earlier cutting, the plentiful use of manure, and the economical supply of water."

21. The last is a point on which Mr. Robertson has often laid stress, and it would be well that some experiments should be made by him to ascertain practically the amount of water required.

22. The Collector of Chingleput will invite the attention of the Superintending Engineer to the remarks in paragraphs 34 and 35 on the low level of the calingula of the Mylapore tank.

23. SPECIAL CROPS.—Of the special crops experimented with "New Orleans cotton" and indigo seem to be the most satisfactory. The first is now sown earlier than formerly; its "unproductive period of growth" has been reduced, and the "style of the plant" has altered for the better.

24. Time is still required to ascertain how far these improvements can be made permanent.

25. The experiments made with indigo in past years "were attended with failure oftener than not," but the results now obtained are such as to justify the belief that the right system of cultivation has at length been ascertained. It is therefore explained in detail, and it is remarked that if the refuse from the vats is returned to the land, and the roots ploughed in as a preparation for a cereal crop, indigo is really a "restorative" crop. This fact, the Board observe, is well known to, and acted upon by, the ryots in some parts of the country.

26. Fair success appears to have been attained with Sunn hemp, jute (*Corchorus capsularis*) and rhea grass, but the Bahmieh cotton which has obtained such repute in Egypt has not yet succeeded at Saidapet.

27. The buffalo grass is said "to grow fairly," but, as though "kept under partial shade" and occasionally watered, it has not yet spread; it does not seem likely that it will be found of much practical advantage under ordinary conditions in this country. The late droughts have on the other hand only served to exemplify the vitality of the guinea grass.

28. In paragraph 77 it is stated that some experiments are being carried on "in the growth and curing of tobacco" under the management of Mr. Schiffmayer, and the Board presume that the remarks as to "cultivation of the crop" in the paper of that gentleman on "tobacco and its culture" appended to the report are based on the results obtained. This should be stated.

29. MANURES.—No extensive or very definite trials of the effect of manures have yet been entered on, but the matter is kept in view, and the results obtained on fields dressed with different manures are carefully recorded for future reference when further experience has been gained.

30. STOCK.—As it has not yet been found possible to remove the Commissariat Slaughter-houses, the stock-breeding experiment is still deferred.

31. The remarks under the head "Live-stock" are therefore chiefly general; the necessity of housing cattle for their health and in order to preserve the manure being insisted on. A useful record is given of the milk yielded by an Aden cow under certain specified conditions, and some account is afforded of the method of management found most successful in lessening the mortality among lambs.

32. ESTATE.—Under the head "Estate" an estimate is given of the cost of forming a casuarina plantation and the probable gain therefrom. This is based on the experience acquired on the Farm where the trees planted towards the end of 1876 have "attained in some cases the height of at least twenty feet." The abundant use of manure and care in watering are believed to have effected these results.

33. SCHOOL OF AGRICULTURE.—The satisfactory nature of the work done by the bulk of the students in the School of Agriculture and the intelligent interest taken by all in the subjects which formed their course of study are testified to by the lecturers generally, and demonstrated by the results of the periodical examinations.

34. Mr. Western remarks that "where there has been failure it is to be mainly attributed to a want of rudimentary education, and in particular to an imperfect knowledge of English."

35. Mr. Robertson also states that the young men who, from their having passed the Matriculation and other examinations, are presumably the best educated have made the most use of their opportunities.

36. These facts seem to point to the advisability of raising the standard of the entrance examination. The untrained mind must necessarily find it difficult to assimilate the somewhat strong and unaccustomed food provided for it, and those who have been able to obtain the advantages of the higher education will very generally be found among the classes best in a position to carry out practically on their own or family lands the instruction they receive. Improvements in the agricultural processes of the country must, the Board conceive, be demonstrated to, and worked out by, the larger land-holders before they are accepted by the cultivators as a body.

(A true Copy and Extract.)

(Signed) L. A. CAMPBELL,
Acting Sub-Secretary.

Proceedings of the Board of Revenue, dated 15th March 1879, No. 698.

Read the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of the Government Farms, to J. STURROCK, Esq., Acting Secretary to the Board of Revenue, dated Saidapet, 4th March 1879, No. 291:—

I HAVE the honor to submit the following explanations with reference to the Proceedings of the Board, No. 472, of the 21st of February last.

2. *Paragraph* 12.—The usual wages were paid, that is, for an ordinary laborer Rs. 5 and for a ploughman Rs. 6 per mensem.

3. *Paragraph* 21.—The inquiry suggested has long been considered one of the most important on which we could be engaged, but the absence of a reliable supply of irrigation water in sufficient quantity throughout the year at suitable portions of the Farm has prevented anything being done in the direction suggested except on a very small scale. It was with the intention of supplying water for a set of irrigation experiments that the channel was made from the Chembrumbaukum tank, which is referred to in the Proceedings of the Board, No. 3,403, of the 18th of December last. As is clearly shown in these Proceedings the channel is not likely to fulfil the object for which it was intended. Before considering further the proposal that has been made to make a more perfect channel from the tank at a considerable expenditure, it would be well, I think, to consider whether the river channel made through a portion of the Farm a couple of years ago could not be extended to the portion of the Farm on which it was intended to carry out irrigation experiments. My own belief is that the channel could be extended to the land in question at a very moderate cost compared with the cost of making the improved channel, and instead of using the water of a tank which is already fully utilized we would make use of a supply of water which in most seasons flows away into the sea; while the river channel would possess the still further advantage of being entirely under the control of the officers of this department. By the Chembrumbaukum channel the water would be delivered on the land by gravitation, whereas the water from the river channel would have to be lifted from 7 to 10 feet in height; this is the only drawback. I will have plans and estimates prepared for extending the river channel as proposed for submission to the Board.

4. *Paragraph* 28.—The remarks relating to the cultivation of the crop and its after-treatment in Mr. Schiffmayer's paper on tobacco culture have special reference to the climate, &c., of this part of India. The full results of the experiments will be published in the annual report now being prepared.

5. *Paragraph* 36.—It will, I think, be necessary to make some alterations regarding the time when admissions are granted to the School of Agriculture. It has been suggested to me by the Director of Public Instruction that if we admitted new classes in the beginning of April instead of the beginning of September, we would secure a great many more matriculated students. The Matriculation Examination is held in December and the results are published in February; this would afford time before the 1st of April to select the men for the new class. Now that we will shortly have a supply of water for carrying on some cultivation during the summer months, I see no serious objection to the time of admission being altered as suggested, and it will certainly be a convenience to commence a new class with the beginning of a financial year. I will address the Board separately on this subject.

FORWARDED to Government in continuation of Board's Proceedings, dated 21st February 1879, No. 472.

(A true Copy and Extract.)

(Signed) L. A. CAMPBELL,
Acting Sub-Secretary.

ORDER THEREON, 16th June 1879, No. 1,286.

THE Government have read with much interest the report of the Superintendent, Government Farms, on the operations on the Farm at Saidapet during the year 1877-78—a very exceptional season. The report has been summarized by the Board of Revenue and no detailed notice by Government is requisite.

2. It has often been pointed out that the value of these reports is much impaired if their publication is delayed, and the Government observe that the Superintendent's complete report for the year ending the 31st March 1878 was not submitted to the Board until quite the end of January last.

This delay appears to have been due to the Superintendent having waited to include the papers noted in the margin, which are dated November and December 1878; and the Board of Revenue consider that the Farm Report should be submitted by itself and not be accompanied by the report on the School of Agriculture, by papers such as those just referred to, or by extracts from correspondence and reports to Government which have generally already appeared and been circulated in detail.

"Supply of water to the soil."
"Manuring, Rotation of crops and fallowing."
"Tobacco and its culture."

3. Having in view the necessity of the early publication and distribution of the Farm Report the Government agree with the Board, who will hereafter review the report immediately on receipt, and forward it with the least possible delay. The report on the School of Agriculture will also be sent in separately through the Director of Public Instruction, who will transmit it with his own remarks to Government in this department where it will be reviewed as suggested by the Board.

4. In regard to the Saidapet Farm the Government observe that no attempt has yet been made to separate Capital and Revenue expenditure and to exhibit financial results in the manner desired by the Secretary* of State, though a table showing the change in value of the estate and stock is appended.

* *Vide* despatch in G.O., 2nd April 1878, No. 519.

It seems probable that the Farm books were not hitherto kept in a manner that would enable a regular financial statement to be prepared without some difficulty, but the Board have recently issued instructions as to the use of the forms of accounts prescribed by the Government of India, and no such difficulty should be experienced in future.

Board's Proceedings, 2nd May 1879, No. 1,159.

5. The attention of the Director of Public Instruction will be drawn to the Board's remarks in paragraphs 34–36, and his views on the proposal to raise the standard of the Entrance Examination to the School of Agriculture are invited.

6. The progress and working of the School have on the whole been very satisfactory, and the want of accommodation complained of will be rectified by the construction of the buildings, the erection of which has hitherto been unavoidably delayed.

(True Extract.)

(Signed) J. H. GARSTIN,
Acting Secretary to Government.

REPORT

ON THE

SAIDAPET EXPERIMENTAL FARM, &c.,

FOR THE

YEAR ENDING 31st MARCH 1879.

MADRAS:
PRINTED BY E. KEYS, AT THE GOVERNMENT PRESS.
1879.

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THE BOTANICAL AND EXPERIMENTAL GROUNDS.

1. THESE grounds, which were briefly referred to in paragraph 31 of the last report of the School of Agriculture, occupy a piece of land measuring about 5·2 acres which was set apart for the purpose early in 1877.

They are divided into three plots, each plot being a terrace rising by gradation from the river bank. The site was selected on account of its proximity to the College site, and its easy access from the main road of the Farm, which constitutes its northern boundary; and also on account of the facility with which water for irrigation can be obtained from a water-lift close by, as well as from the channel forming its western boundary. The soil had nothing to recommend it, being in some parts indeed of the worst description met with on the Farm, consisting chiefly of coarse sand, but it was thought that the application of clay, a bed of which was met with whilst excavating the channel mentioned above, and a liberal supply of manure, combined with judicious treatment, would bring the soil into a sufficiently fertile condition in a short time; an expectation which had been completely realized whithin one year and a half.

Arrangement of the upper terrace.

2. On the upper terrace the ground was laid out in four slopes and two ridges for irrigation purposes according to the ridge and furrow system. The soil needed to fill the hollows and the lower portion was obtained in excavating the channel. After the ground had been levelled, the whole field received a dressing of black clay to the depth of three inches. The next heavy rain dissolved the clay and washed it into the soil, distributing it through the surface soil. The ground was then dug over to a depth of $1\frac{1}{4}$ feet, and the land was divided into four equal sized main plots by two roads, one running through the centre of the field from north to south at right angles to the main drive of the Farm, and the other road running from east to west. Each main division was then sub-divided by an irrigation channel, made of concrete, laid on the ridge, running from east to west, and each sub-division was again divided into six beds, each measuring 36 feet in length and 18 feet in breadth, leaving foot-paths 4 feet wide between each. Each bed is thus connected with the irrigation channel from which it receives its water by means of a drainage pipe inserted in the concrete channel. Around the whole field a margin nine feet wide was left, and at the inner side of the margin a path was made, thus making every portion of the garden easily accessible. The roads were made from 10-12 feet wide. The land was then allowed to lie untouched for several months, after which time it received a second dressing of clay and was again dug over about 1 foot deep, and on being heavily manured with horse-dung was fit for cropping at the commencement of the year 1878. This portion was laid out chiefly with the view to afford instruction to the students of the Agricultural College; to conduct experiments on a small scale with plants regarding the habits and requirements of which little or nothing is known; and finally to acclimatize and propagate plants raised from imported seeds.

3. In order to ensure success in acclimatizing plants they must receive more attention than can be bestowed upon crops when grown in the fields. A plant grown from seed newly imported often meets with conditions differing greatly from those under which it grew formerly, and to which it was accustomed; such plants must be carefully attended to; their growth must be carefully watched, and the minutest changes must be noted as indicating the wants of the nurslings and

showing in what direction the treatment must be altered to aid their growth or to effect a cure. It is of the utmost importance in conducting experiments in the acclimatization of plants, &c., to secure the conditions most favorable for their growth and to eliminate everything that may cause any disturbance. It may perhaps be remarked that plants that require so much attention are of little agricultural value. It must, however, be remembered that plants of a high type, like animated beings, when placed under conditions much dissimilar to those they have been accustomed to, will suffer more or less, and that their organic structure must undergo a change and must adapt itself to new circumstances, and until this is effected the plant must go through a crisis out of which it will pass triumphant, if the conditions affecting its growth have not been too strongly opponent to its wants. Great care must consequently be taken to eliminate any disturbing elements, or the plant may fall a victim to circumstances that are uncongenial to its growth, and to which it cannot accommodate itself. After a plant has once arrived at maturity under certain circumstances, there will be but little difficulty, with common care, in propagating the species; although most probably a new variety may be formed under the altered climatic influences.

Difficulties of acclimatization.

4. The arrangements made in this part of the garden are such that a great diversity of plants can be grown on a small scale for the demonstration to students of the value of different species and varieties. Although the chief aim is thus to raise such plants that are, or promise to become, valuable to the Agriculturist, the botanical side of the question has not been lost sight of. Arrangements have been made to raise a great variety of plants solely for the purpose of providing specimens for demonstration in the lectures on Botany: in this respect the garden is an appendage to the lecture-room.

5. The second terrace, which lies on a level a few feet below that already described, was laid out as follows. A margin 4 yards wide around the whole field was divided into small beds in which it is proposed to grow trees, grasses, vegetables, &c. The centre portion of the field is divided into two plots of equal size by a road running from north to south; this road is a continuation of the central road of the upper terrace. The plots measure about five-eighths of an acre each and are large enough to admit of field operations being performed by means of cattle power. The plots can be easily irrigated from the well close by, but the land having been levelled only about a year ago, and the soil not uniformly weathered as yet, does not admit of regular cropping, nor is it fitted for experiments. The land was laid out chiefly with a view to propagate such species of plants as may have been partly acclimatized; and to conduct experiments on a larger scale than in the first terrace and under conditions more nearly resembling those met with in ordinary field practice.

Arrangement of the second terrace.

6. The following are some of the crops that have been raised during the past year.

7. *Yellow Cholum* (Sorghum vulgare).—This crop having been very much attacked by smut during the year 1877, an experiment was instituted to ascertain the strength of a solution of sulphate of copper necessary for dressing the seed to prevent the attacks of that fungus. For this purpose 4 plots of the ground were set aside, each bed measuring 6 yards in width and 12 in length; each plot was made up into six ridges, each ridge measuring therefore 1 yard from centre to centre; the ridges were 2 feet wide and between them a furrow 1 foot wide was left. All the beds had been treated alike as regards depth of digging the soil and amount of manure used. In each bed, 1,000 cubic centimetres, or a little less than 2 lb. of seed were sown in 4 lines on each ridge, the lines being therefore 6 inches apart. For the first bed the seed was steeped in 750 c. c. of pure water ($\frac{3}{4}$ths of the volume of the seed used). For the second bed the same amount of seed was steeped in 750 c. c. of water in which 2 grammes of sulphate of copper had been

Experiment with dressings of sulphate of copper.

dissolved (the amount of sulphate of copper in the solution being in this case 0·266 per cent.) For the third bed 1,000 c. c. of seed were steeped in 750 c. c. of water in which 6 grammes of sulphate of copper had been dissolved (the amount of the sulphate of copper in the solution being here equal to 0·798 per cent.) The fourth and last bed was sown with 1,000 c. c. of seed steeped in 750 c. c. of lime water. The seed in every case was steeped for 15 hours and was sown on the 8th of May 1878 ; it germinated freely, and when the plants were about six inches high the crop was hoed. After hoeing no water was applied on the ridges, but the water was let into the furrows between them; to prevent the formation of any surface crust. No further hoeing was required, the plants growing rapidly and suppressing all weeds. The plants grew uniformly in all the beds until they were about 7 feet high, when the plants raised from seed steeped in lime water grew more rapidly than those in the other beds and attained a height varying from 12—14 feet; the crop in the remaining beds reached a height of only from 10—12 feet. The cholum was fit for cutting in the middle of August; but was not cut until about a month later on account of unfavorable weather. The cholum in all the beds was a little attacked by rust but no smut was met with. The outturn of green fodder was as follows :—

Amount used and method of steeping.

Bed.	Treatment of Seed.	Yield per Plot.	Yield per Acre.
		LB.	LB.
B 11 ...	Steeped in pure water	1,126	75,692
B 9 ...	Steeped in water containing ·266 per cent. of sulphate of copper...	980	65,878
B 7 ...	Steeped in water containing ·798 per cent. of sulphate of copper..	1,176	79,053
C 4 ...	Steeped in lime water	1,344	90,346

Although the result of the foregoing experiment did not contribute anything to answer the question for the sake of which it was instituted, the results obtained are very valuable in showing what can be effected by high cultivation. The soil on which the cholum grew was nearly sterile in 1876, and in 1878 a crop was obtained at the rate of 90,000 lb. per acre, which is more than twice the amount of cholum fodder received at one cutting from any field on the Farm previously. The greatest amount of fodder was yielded by the bed in which the seed sown had been dressed with lime water. This was probably due to the stimulating effect that lime exercises on vegetable life.

8. It being well known that when a very strong solution of sulphate of copper is used for dressing seed it decreases its vitality, an experiment was made to ascertain how far seed raised in this country is affected by the dressing. For this purpose American maize seed was used. The cobs, from which the grain was obtained, had been harvested before the end of March and were dried for a few days before the experiment commenced. On the 2nd of April at 9 A.M. 400 grammes (12·86 oz.) of seed were placed to steep in pure water; 400 grammes in water in which $2\frac{1}{2}$ grammes (38·58 grs.) of sulphate of copper ($Cu.S.O_4$) had been dissolved; 400 grammes in water in which 5 grammes (77·16 grs.) of sulphate of copper had been dissolved; and 400 grammes in water in which 10 grammes (154·32 grs.) of the same salt had been dissolved.

Test of the effect of sulphate of copper on the vitality of seed.

The seed was placed in chatties of the same size, and water was used in such an amount as to cover the seed with about one inch of water. This water was poured off on the 3rd April at 3 P.M., and the seed was then left in the chatties, and covered with moist blotting paper until the 6th of April at 3 P.M. when it was examined and the seeds that had sprouted counted. The following are the results :—

Sample.	Total Number of Grains.	Grains sprouted.	Grains not sprouted.	Sprouted, per Cent.	Remarks.
No. 1.—Steeped in pure water.	1,305	1,172	133	89	Most of the germs from ½ to 1½ inch long.
No. 2.—Steeped in water in which 2½ grammes of Cu. $S.O_4$ had been dissolved.	1,260	872	388	68	Most of the germs from ½ to ⅛th of an inch long.
No. 3.—Steeped in water in which 5 grammes of Cu. $S.O_4$ had been dissolved.	1,445	497	948	34	Germs only appearing and looking sickly.
No. 4.—Steeped in water in which 10 grammes of Cu. $S.O_4$ had been dissolved.	1,274	212	1,062	16	Germs only appearing and looking dead; some of the germs being apparently destroyed by the strong solution in the act of appearing.

The results of this experiment show clearly that by using a large amount of sulphate of copper the vitality of the seed will be destroyed. If the result obtained with the sample steeped in pure water represents the normal vitality of the seed, then, in sample No. 2, 21 per cent. of the vital seed was destroyed by the solution of copper. The dressing in this case was at the rate of 11·7 oz. of the salt per 100 lb. of grain. Although in the practice where the seed is put into the soil the loss would not amount to 21 per cent., especially when the soil is rich in lime, yet the amount of sulphate of copper used for the second sample was far too much for practical purposes.

9. If the seed had been steeped for a shorter time the vitality would have been probably greater. According to Kuhn, Dreish, and others who have made numerous experiments on this subject not more than 5 oz. of sulphate of copper should be used per 100 lb. of grain, and even then the loss of vitality of some of the grains cannot be entirely prevented. Most probably some of the germs that appeared to be dead will revive again when put into the soil, and some grains that appear to have no vitality may germinate under more favorable conditions, it being well known that seed that has been dressed with sulphate of copper germinates later than others that have not been dressed, and also that those which are heavily dressed germinate more slowly than those to which only a light dressing is supplied.

10. Steeping is considered better than sprinkling because when the seed is steeped the solution must penetrate into the grain and can then destroy such spores as are imbedded in the seed. The results obtained in this case tend to corroborate the assertion mentioned above, but it will be necessary to repeat the experiments to ascertain the amount of sulphate of copper that should be used for the dressing of various grains to secure the best effects. It should, however, be remembered that the loss of vitality on the part of the less vigorous seed may be an advantage within certain limits in keeping out sickly plants from the crop.

Effects of deep and shallow sowing.

11. Another set of experiments was instituted with yellow cholum to investigate the effect of deep and shallow sowing. For this purpose three beds were sown on the 19th of October. The soil of the beds was uniform and their preparation alike. In one bed the seed was placed 1 inch; in the second 3 inches; and in the third 5 inches deep. The seed in all the beds germinated very well and the plants grew with uniform vigor until about 2 feet high, when the plants growing from the seed sown 1 inch deep commenced to suffer from the effects of the powerful

sun prevailing at that time, and were soon afterwards so severely attacked by rust that it appeared as though every function of life were extinct. The plants raised from the seed deposited 3 inches deep were but little attacked by rust, and those raised from seed sown 5 inches deep were nearly free from the disease. Soon after the rust appeared, the beds on which the cholum was growing were watered every day to such an extent that the soil was thoroughly soaked. This was continued for about a week, when it was observed that the cholum, that was stunted, had revived again and was making a fresh start; it afterwards attained nearly the same height as that in the other beds. The rust, which had covered nearly the whole plants at the middle of November, had almost entirely disappeared a month later.

The crop was cut on the 3rd of February 1879. The following table shows the weight of green fodder received from each bed:—

Bed.	Treatment of Seed.	Yield per Plot.	Yield per Acre.
		LB.	LB.
C 5 ...	Sown 1 inch deep	252	16,940
C 4 ...	Do. 3 do. do.	208	18,823
C 3 ...	Do. 5 do. do.	368	24,737

The results of this experiment are very instructive. They show clearly that the plants only suffer from this disease (rust) when they are weakened and the functions of life are paralyzed by adverse conditions, and that they can recover their vigor if the principal cause of the disturbance is either removed or its effects neutralized at the proper time.

12. Owing to the fact that the roots of the plants, sown shallow, would be more confined to the surface than those of the plants sown deep, and through the temperature of the surface soil being raised by the direct action of the sun, the roots of the former plants were exposed to inimical circumstances which probably were so powerful as to impair the exercise of the functions of preparing and conducting food to the other parts of the plants on their part, and thus caused the debility of the whole plant, and nullified its power of resisting the attacks of disease. The results of this experiment are different to those of others made on the Farm with crops grown under dry cultivation. In some of these experiments the seed sown at 5 inches in depth failed to germinate. This apparent contradiction may be attributed to the differing conditions of the soils experimented with, and illustrates the necessity for repeating such experiments under as great a variety of circumstances as possible before attempting to draw general deductions.

Sowing seed at various distances.

13. A third experiment with yellow cholum was instituted to determine the effects of sowing seed in lines at various distances apart; and three beds were set aside for this experiment (the same as those in which the Sorghum to be referred to grew). In one bed two lines were sown on each ridge; in the second bed three, and in the third four lines. The soil of all the beds was similar and the ridges were of equal size. The seed, which had been steeped in lime water, was sown in equal amounts in all the beds on 19th October; it germinated well and the plants grew uniformly and vigorously.

The crop was cut on the 28th of January last with the following results:—

Bed.	Number of lines sown on each ridge.	Yield.	Yield per Acre.
		LB.	LB.
A 1 ...	2	448	30,116
A 2 ...	3	481	32,334
A 3 ...	4	504	33,981

It will be noted that the yield was heaviest where four lines had been sown on each ridge and where consequently the lines stood more closely. This is in accordance with general experience. Fodder raised in this manner is also usually more tender, and juicy, and therefore both better food for, and more palatable to live stock.

14. *Chinese Sugarcane* (Sorghum saccharatum).—This crop having as yet only been successfully grown on the Farm as a cold season crop, an endeavor was made to grow it in the hot weather. For this experiment three beds were used, which were all similarly prepared and the soil of which was alike. The seed was sown on the 27th July 1878; in the first bed ½ inch deep, in the second 2 inches deep, and in third 4 inches deep, it germinated well and the plants grew vigorously. The crop was watered occasionally and was cut on the 16th October. The yield was as follows:—

Bed.	Depth of sowing seed.	Yield.	Yield per Acre.
		LB.	LB.
A 1 ...	½ inch	520	34,956
A 2 ...	2 inches	622	41,812
A 3 ...	4 „	678	45,577

The results of this experiment show that under high cultivation and occasional watering the crop may be grown during the latter part of the hot season as well as during the cold weather. It must however be mentioned that the favorable result is undoubtedly greatly due to the peculiar weather, which was very favorable for growing crops, during August and September. The heaviest outturn was also here obtained from seed sown deeply.

15. *Black Cholum* (Sorghum?).—On the 11th June, two beds were sown with black cholum obtained from Trichinopoly. The seed germinated well, and the plants grew very rapidly and attained a height from 11 to 12 feet. The plants closely resembled the Chinese sugar-cane, but the stalks were rather thinner and the panicle spread less, that is, the heads were less open. The following are the results obtained:—

Bed.	Yield of Fodder.	Yield per Acre.
	LB.	LB.
C 3	744	50,013
C 5	688	46,248

The outturn certainly is very satisfactory; these figures show that black cholum grows very well, and better than the Chinese sugar-cane during the hot season, for the seed was sown in June, a month earlier than the crop above referred to, at which time the weather was very unfavorable for the growth of crops.

16. *Red Cholum* (Sorghum?).—On the 21st June, two beds were sown with this crop. The seed, which had been obtained from Salem, germinated very well and the plants grew vigorously at first; but when about 2 feet high they gradually withered up. It was evident that either the weather or the soil did not agree with them. The plants attained only a height of 6 to 7 feet and the crop was cut on the 21st of September, exactly three months after sowing; the outturn was at the rate of 33,000 lb. per acre.

17. *Maize* (Zea mays).—During the year 1877 seeds of ten varieties of Maize were received from Italy. They were sown in small beds in January 1878. The seed germinated freely but the plants did not succeed well. They evidently suffered from the powerful sun. The plants reached a height of about 6 feet and matured a few cobs, which however were small. Some seed of the best varieties thus obtained was sown on the 10th of December 1878. Although the plants raised

from this seed grew more vigorously than the mother plants and the cobs were much larger than the first time, yet neither did the plants nor the cobs attain the size of the American maize.

An interesting phenomenon was observed on one of these plants. The male part of the flower instead of being separated from the female was connected with it and remained in this position until the cob attained maturity: generally the male flower crowns the plant, the female being situated part way down the stem.

18. Some maize seed obtained from America, was sown on the 10th of December last. The seed germinated very well and the plants grew luxuriantly. Many of the plants produced two cobs, all of which were of great size; the following figures show the weight of some of them. One cob, weighing 14½ oz. contained 710 grains which weighed 8 oz. Another cob weighing 13 oz. and contained 611 grains which weighed 7½ oz. The yield was at the rate of 823 lb. of grain per acre, which is very satisfactory considering the nature of the season.

19. *Wheat.*—Two samples of common wheat, one red and the other white, were received from the North-West Provinces; samples were also obtained from Bellary and Kurnool, and of spelt wheat from Cuddapah and Salem. On the 3rd of October a bed was sown with each of these 6 samples. All the wheat germinated well, but the plants raised from Salem spelt wheat and Bellary wheat suffered from the commencement and the plants died within three weeks after they appeared above ground. The plants raised from the red wheat received from the North-West Provinces grew well at first, but commenced to wither within about five weeks after their appearance above ground. The plants of the remaining varieties grew very well at first but were checked in the latter part of November, reviving however again in December and growing very vigorously afterwards: they attained a height of about 2 to 2½ feet. The plants flowered in the middle of January and the crop was harvested in the middle of February. The outturn of grain was very small, most of the ears being empty. This is the first time that wheat has been cultivated here with any success, and had it not been for the exceptionally bad season the yield of grain would have been much better; a somewhat stiffer soil than that used would probably also, have increased the outturn.

20. *Grasses.*—The following are some notes made on the growth of some grasses raised from seed obtained from Queensland.

Andropogon halepensis.—Six feet high at present, flowered some weeks ago; stem succulent but attacked by rust. This is undoubtedly a heavy fodder producer.

Festuca Billardierii.—Stem one foot high, rather wiry, has few leaves, may be a good cattle food when mixed with more tender species.

Chloris ventricosa.—1 foot high; more wiry than the foregoing, but possesses more leaves.

Panicum spectabile.—Very similar to the foregoing.

Andropogon annulatus.—4 feet high; growth not completed; not yet flowering.

Arundinella Nepalensis.—1½ feet high; flowering at present; possesses a considerable number of leaves, but is rather coarse; it may prove a useful fodder for mixture with other grasses.

Sporobolus elongatus.—A grass with a flattened stem and with roots ramifying greatly, well adapted to a hot climate in this respect; but rather coarse.

21. *Guinea Grass* (Panicum jumentorium).—Some seed having been collected on the Farm last year a few small beds were sown with it. The seed germinated very well. The plants grew remarkably vigorously and the leaves attained an extraordinary breadth and reached a height of about five feet. The tendency to produce leaf seems to be greater with plants raised from seed, than from those grown from roots in the usual way.

22. *Sea Island Cotton* (Gossypium Barbadense).—A supply of seed of this variety of cotton having been obtained from America last year, one bed was sown with it on

the 10th of May. Great difficulty was experienced in raising the plants, for the seed had a very low percentage of vital grains, and, although it was sown very thickly, the plants appeared unevenly over the ground, which necessitated several resowings to fill the blanks. To prevent the surface from being crusted over, which is so detrimental to germination and to the first growth of plants, the seed was first covered with about one inch of soil and then with about two inches of horse manure. The beds were also frequently watered to keep the temperature of the soil low, but in spite of these precautions the plants made little progress at first. The showery weather of August and September revived the plants, which after that time grew very vigorously. The plants flowered profusely during October and November, but all the flowers dropped off. The rank growth during August and September probably caused this. The cotton again commenced to flower heavily in December; this time very few of the flowers dropped off. Some cotton was gathered from January up to March; that gathered in January was the best, the boles being large and the lint very long. Most of the boles produced during February and March were attacked by an insect, which was generally found inside the seeds and thus prevented the seed from maturing and lessened the amount of lint produced. Some of the seed received from this bed has been already sown in another plot, where it germinated freely.

23. Some *Upland Cotton* seed (Gossypium hirsutum), also obtained from America, was sown at the same time as the Sea Island Cotton. The seed germinated much better than that of the latter variety, and the plants grew slowly but steadily; they also did not produce so much wood and leaf. Flowering commenced later and the flowers were fewer in number than in the case of the Sea Island Cotton, but few of the flowers dropped off, and the yield was much better. The cotton was all gathered in the middle of March, when apparently all circulation of sap had ceased. The plants then were cut down one foot above the ground and the plot was watered and dug over. At the end of the month the old stools were throwing out fresh shoots. The lint of this cotton is very short, but the variety is very much esteemed in America on account of the heavy outturn it gives; it is said that while Upland Cotton yields 400 to 500 lb. of lint per acre, the Sea Island Cotton yields only 200 to 250 lb.; so that, although the price of the latter cotton is much higher than that of the former variety, an acre of Upland Cotton yields more profit than one of Sea Island.

24. *Yca Valley Cotton.*—A few seeds of this valuable variety were sown in January 1878, and two plants were raised from it. The plants grew slowly but steadily until they had attained a height of about 7 feet in December 1878. The plants flowered in September and October last but all the flowers dropped off. Some seed however was gathered during February and March, which will be sufficient for propagation. The seed is very large and when fresh its surface is very oily. This accounts for the lint being often stained.

25. The following are some results obtained in weighing the seeds of the three varieties of cotton already referred to :—

Variety.	Seeds in 1 lb.
Yca Valley	7,000
Sea Island	9,000
Upland	14,000

25. *Bamieh Cotton.*—Some seed of this cotton was received from the Government of India early in the year, and was sown on the 5th of April. The seed germinated well and the plants grew vigorously until most of them had attained a height of about 7 feet in September, when they commenced to flower; but as nearly all the flowers dropped off, only a few seeds were gathered. The plants stood very closely on the ground and developed very few side branches; but some of the seed

raised here when sown produced shorter and more branched plants, these showed the latter tendency so strongly that they differed little from the New Orleans cotton. The plants being much attacked by insects were cut down to one foot above the ground and had commenced to shoot from the old branches before the end of March. From the result of this experiment it would appear that the character of this cotton is the result of a particular cultivation and is not fixed enough to mark it as a separate species.

26. *Brazil Cotton* (Gossypium religiosum).—Some seed of this species of cotton was sown on the 22nd May 1878; it germinated well and the plants grew vigorously until they were about 6 feet high in November last. The plants then commenced to flower, but most of the flowers dropped off and only a few seeds had been gathered at the end of March. The peculiarity of this cotton is that the seeds are closely attached to one another. The state of growth is very bushy and the plant might well be used as an ornamental shrub in gardens. Some of the plants were cut down to one foot above ground during the month of February to ascertain whether this may not induce them to produce better.

27. *Nankin Cotton* (Gossypium Siamese rubra).—Some seed of this variety of cotton was received from Italy, with the maize already referred to, and sown in the month of January. The seed germinated but the plants have not thriven well; they are very small and have produced but little up to date. Some of the seed gathered will be again sown, and it is possible that the plants raised from this seed will thrive better than the plants grown from the imported seed. As far as may be judged at present this cotton does not possess any great agricultural value.

28. *Hemp* (Cannabis sativa).—Some beds of hemp are now growing on the grounds. Although the plants appear healthy yet they require evidently a moister atmosphere and a lower temperature of soil than that met with here at this time of year. Some of the plants even commenced to flower before the end of March, when only about 4 feet high, which completely destroys the hope of obtaining a fair yield.

29. *Malachra rotundifolia.*—Some seed of this fibre plant was received from Student N. H. Patuck, who obtained it from Bombay where, it is said, the plant grows wild. The seed was sown at the commencement of February 1879, at first the plants grew very slowly and appeared stunted, but on supplying them with enough water to keep the soil always moist they revived and grew very rapidly and had attained a height of 3 feet at the commencement of April 1879.

30. *Jute* (Corchorus capsularis).—On the 4th of February three beds were sown with this crop. The seed was sown very thickly, four lines in each ridge. The seed germinated very well but the plants grew very slowly until about the 20th of March, when they were about 9 inches high, about 2 inches of rain fell on that and the two following days, and the weather continued to be cloudy for several days longer. During this time the plants grew so rapidly that at the end of March most of them were $4\frac{1}{2}$ feet high. As the plants stand very closely they are all remarkably straight and have few side branches.

31. *Indigo* (Indigofera tinctoria).—Some beds were sown with indigo chiefly with the view to ascertain what yield can be obtained under high cultivation. The seed was sown on the 25th November 1878. The seed germinated well and the plants grew vigorously and had attained a height of 4 feet, when the crop was cut on the 5th March 1879. This cutting yielded at the rate of 120 bundles per acre; each bundle weighing 92 lb. The yield is certainly very heavy for a first cutting. Commonly sixty bundles of the same girth, each weighing 60 lb., is considered a fair yield. The crop was however occasionally watered.

32. *Tapioca* (Jatropha manihot).—On the 21st of August a bed was planted with cuttings of this crop. The cuttings were placed half yard distant in the lines and the lines were 1 yard apart. The cuttings struck root easily and attained a height of 6-7 feet. The plants were cut down and the tubers taken up on the 4th March 1879. The yield of tubers was at the rate of 10,880 lb. per acre. This outturn

is certainly very satisfactory. The plants are most easily propagated and require little attention during their growth. As the branches and leaves soon cover the ground little irrigation is necessary.

33. *Arrowroot* (Curcuma augustifolia).—A bed was planted with this crop on the 19th August 1878; it grew fairly, but required more water than the tapioca; the tubers were taken up on the 1st of March; the yield was found to be at the rate of 3,764 lb. per acre.

34. *Castor.*—Seeds of the following nine varieties of this plant were received from Italy at the close of the year 1877 :—

Ricinus communis.	Ricinus communis cyclonthe.
„ „ herbaceum.	„ microstatum.
„ „ cuban.	„ miscrospermum.
„ „ utilosus.	„ purpureum.
„ „ spectalite.	

They were sown on the 16th January 1878. Nearly all the seeds germinated and the plants appeared above ground on the 24th January. The plants all grew very vigorously and some of them attained a height of 10 feet in a short time. Only a few seeds having been received, the seed of all varieties was sown in one division of the garden; the different varieties consequently grew in proximity to each other. Of each variety 2—6 plants were raised, except of *Ricinus mycrospermum*, which is the medicinal castor-oil plant, of which 14 plants were raised. The plants flowered and produced seed nearly throughout the year. Some of the trees yielded very well. Of the species *Ricinus purpureum* two plants were raised; both trees grew to a great height; these trees are very ornamental, being profusely covered with leaves and flowering and bearing continually, and would make a very good shrub for gardens. These two trees are in appearance alike, but the seed differs very much; the beans of the one tree being much larger than that of the other. The produce of one of the trees amounted to 15 lb. of beans during the year.

It would appear that all the plants hybridized except the *Ricinus mycrospermum* as none of the seeds of two trees are exactly alike. The *Ricinus mycrospermum* it would appear did not hybridize on account of the characters of the plant being more distinct from the other varieties than those of the remaining varieties between themselves. Not only the seed of *Ricinus mycrospermum* but also the plant varies very much from the other varieties; the color of the plant is light green and the leaves themselves possess this color; the whole tree has the appearance of an umbelliferous plant growing in a globular form, which habit gives the plant a nice appearance.

35. As all the varieties grew very well, it may be assumed that, after being fully acclimatised, some of them will be found to be well adapted to the conditions met with in this country and at the same time to produce better results than those cultivated at present.

36. *Pithecolobium saman*, the so-called Rain-tree. Some plants of this variety were received from the Horticultural Gardens at Madras at the end of September 1878. Some of them were planted in the Botanical Garden. All the trees grew very well and one of them had attained 10 feet in height at the end of March 1879; this tree grew 7 feet in six months, which proves that this tree is very well adapted to the conditions met with here.

37. We are under obligations to Professor Italo Giglioli, M.R.A.C., of the Royal High School of Agriculture, Portici, Naples, for a valuable collection of seeds from Italy and Sicily, which unfortunately could only be partially utilized; but the maize already referred to, the castor beans, and the Nankin cotton, besides some tobacco seed of the species *Nicotiana macrophylla* were successfully grown; the latter particularly so. To the Acclimatization Society of Queensland we are indebted for several packets of grass seeds, and seeds of a variety of *Eucalypti*; as also are we to W. Hill, Esq., Director of the Botanic Gardens, Brisbane, for similar contributions. According to the present arrangements it is, however, almost impossible to obtain

all the advantages, which such a garden could confer, from these grounds, as the Officer in charge of the Farm is unable to devote so much time to it as is required to ensure perfect success in every direction. Last year, at a time when the garden was not entirely under cultivation, from 300 to 400 varieties of seeds and plants were put down at one time. Their growth could not be satisfactorily watched and attended to in the course of a flying visit to the garden every day, and the result was that many failures had to be recorded, which if more time could have been devoted to the work might have been avoided. The botanical grounds attached to Agricultural Colleges in other countries are generally under the management of the Professor of Botany or Professor of plant culture, which system, if imitated here would open a wide and useful field of investigation in subjects which have been but little studied in this country.

(Signed) K. SCHIFFMAYER,
Asst. Supt. of Govt. Farms in charge.

SAIDAPET,
3*rd May* 1879.

THE ANNUAL PLOUGHING COMPETITION.

1. This competition, after being in abeyance for several years, has been revived, and it is hoped will become a permanent institution. The interest taken in it by all classes, as shown by the numerous gathering on the present occasion, demonstrates its value, for it thus becomes a means of attracting attention and showing the value of improved implements of tillage over those of time-honored use. The matches commenced at 6 A.M. this morning, when the following prizes were competed for :—

Class.	Qualifications.	Prize.	Description of Prizes.	Value.
				RS.
I.	Open to all.	1	A Swedish plough	25
		2	An American plough	20
		3	Implements or seeds	15
		4	Do. do.	10
		5	Do. do.	5
II.	Students of the School of Agriculture only.	1	A Swedish plough	25
		2	An American plough	20
		3	Implements or seeds or Agricultural Books.	$12\frac{1}{2}$
		4	Do. do. do. ...	$7\frac{1}{2}$
III.	Ryots or their laborers only.	1	An American plough	20
		2	Money	10
		3	Do.	5

2. The following gentlemen kindly consented to act as judges :—

Class I ... ... J. H. Garstin, Esq., C.S.I.; J. F. Price, Esq.; L. R. Burrows, Esq.

Class II ... ... H. E. Sullivan, Esq.; Surgeon-Major W. R. Cornish, M.D.; Major B. Hobart, R.A.

Class III ... ... L. A. Campbell, Esq.; F. G. Shaw, Esq.

3. In awarding the prizes the following merits were considered, points being allowed to each as mentioned below :—

	Points.
Depth	25
Straightness	25
General finish	25
Speed	52
Total ...	100

4. The general public were not admitted into the fields during the competition, as the cattle would have been frightened by the presence of such an unusual crowd and have become altogether unmanageable; the land on which the matches were conducted was however so situated as regards roads that the whole of the work could be easily seen by visitors, who were also perfectly free to enter the fields after the competitions were over.

5. In Class I, there were sixteen competitors; of these, nine were laborers on the Saidapet Farm, who worked with farm cattle and ploughs of European pattern, but who, however, had their cattle assigned to them by lot; six were ryots of the neighborhood who worked with the plough of the country; and one a student of the School of Agriculture, who, however, was obliged to retire, as his cattle had never been properly trained. In the field where this class worked, the soil is a sandy loam, and a crop of tennai had been recently harvested: the soil was fairly moist and in good condition for ploughing with European ploughs; although rather too hard for a native one. The prize-winners, who all worked with ploughs of European pattern are mentioned below; the marks awarded are noted and the time occupied in ploughing the plots, each of which was 490 square yards in area:—

Prize.	Name.	Points awarded.	Time occupied.	Rate of ploughing in a day of 8 hours.
			MINS.	ACRES.
1st ...	Mooroogan	98	34	1·49
2nd ...	Ellengolly	82	39	1·25
3rd ...	Annamalay	81	42	1·16
4th ...	Moonoosawmy	75	42	
5th ...	Muttu	74	48	1·01

The work done by the 1st Prize winner was extremely good, and the rate at which it was performed most creditable. The speed at which the cattle travelled was of course greater than that obtained in ordinary field work, but overdriving was in no way permitted. How much depends on the proper training of the cattle was most clearly shown on this occasion, for the winner of the 5th Prize, who took the first previous in competition in 1873, and who has certainly not fallen off in his capabilities, having been allotted a pair of cattle which were rather wild, and which had not been thoroughly trained, was unable to do as good work as had been expected of him. It must not, however, be supposed that a great deal of special training is required, for provided cattle are well broken to the yoke, and are docile, it is quite possible to fasten them to a plough without any extra training; this has often been done on the Farm without the slightest inconvenience. When yoked to a plough of European pattern, as in other situations, the manner in which cattle will work greatly depends on their temper; if they be docile, they will work well; if the reverse, considerable difficulties will always be experienced. The Native ploughs, competing in this class, completed their plots in 56, 33, 32, 49,56, and 36 minutes respectively, but in the amount of work done, that is, soil moved, none of them had in any way come near the competitors using European ploughs; in most cases the soil was only stirred in patches, the greater part being unmoved.

6. In Class II, thirteen students of the School of Agriculture competed; of these—

3 were Brahmins.
5 ,, Sudras.
4 ,, Parsees.
1 was a Native Christian.

The following were the results:—

Prize.	Name.	Points awarded.	Time occupied.
			MINS.
1st ...	Student N. M. Rego	95	48
2nd ...	,, R. Damodara Naidu	83	95
3rd ...	,, A. Mooroogessa Pillai ...	80	74
4th ...	,, N. H. Patuck	75	57

The field in which this competition took place is a fallow, the soil being for the most part a sandy loam; it was not in a very favorable condition for ploughing, being in places very hard. The work done was very creditable, and the judges expressed themselves highly gratified with the way in which the students took to the work without scruple. The students labored under considerable difficulties in the management of their cattle, although the 1st Prize winner showed great skill in this respect. The success they attained is the more creditable, when it is remembered that cattle will never obey strangers as they will their ordinary drivers, and that the students do not work in the same costume as ordinary coolies; their dresses causing a considerable degree of alarm to the cattle they drive.

7. In the Third Class, which was open to ryots and their laborers only, there were ten competitors, all of whom used the ordinary country plough. The plots allotted to them measured 600 square yards, but unfortunately the soil was in a far too dry a state to admit of Native ploughs working at all favorably. The following were the results :—

Prize.	Name.	Points awarded.	Time occupied.	Rate of ploughing in a day of 8 hours.
			MINS.	ACRES.
1st ...	Chellen Naick	76	73	·82
2nd ...	Sathasiva Reddy ...	75	50	1·19
3rd ...	Mooroogappa Naidu ...	74	30	1·98

The work done was very poor; in most of the plots but little of the soil was moved, none of course being turned over.

8. In Class I, the prize winners, working with European pattern ploughs, cut furrows about $7\frac{1}{2}$–9 inches deep, and 9-10 inches wide, thus turning over in every hundred yards of furrow run as much as 150 cubic feet of soil. A Native plough when working under the most advantageous conditions only cuts a triangular furrow about 6 inches wide at the top and 1 inch at the bottom, with a depth of about 5 inches, so that, in travelling 100 yards, it only moves 36·5 cubic feet of soil, or less than one-fourth of that turned over by the European ploughs in this competition. In the competition itself, although at times the depth mentioned above (5 inches) was attained by Native ploughs, they did not maintain that depth throughout their furrows, often missing pieces and probably not doing more than one-sixth of the useful work done by the prize winners in Class I; whilst of the value of the work done with the respective implements, no one who saw the results could have a shadow of doubt. The Native ploughs were nowhere.

(Signed) CHARLES BENSON, M.R.A.C.,
Asst. Supt. of Govt. Farms,
conducting the competition.

SAIDAPET,
12th December 1878.

THE SAIDAPET EXPERIMENTAL FARM.

SECTION I.

GENERAL.

Rainfall.—It has become a custom when estimating the capabilities of a place for agricultural purposes to be guided chiefly by the amount of rain that falls there during the year. Although a great amount of rain in a hot country generally betokens a good year, yet undue importance is often attached to it by persons who, looking only to the total amount of rain, make no allowance for the circumstances that modify the effects of the separate falls. The most important conditions, which affect the value of the rainfall, are the season at which the rain falls and the amount of rain that falls in a given time. The effects of a stated amount of rain must vary considerably according to the season at which it falls and the duration of time over which the fall is distributed, as also whether it falls in the evening or morning. When a fall of one inch of rain is equally distributed over six hours in the cold season its effects must be much more beneficial than when a fall of the same amount occurs during six hours in the hot season. In the first case the water will pass easily into the soil, which is more or less friable at this time, and after passing into the soil the water will not be so easily evaporated, because the temperature is lower, the soil loose, and the surface more or less covered with a crop; whereas in the latter case the water will only partly penetrate into the soil on account of its density, and will also be evaporated within a short time after the rain.

2. As regards a given amount of rain falling in a varying time, it is evident that if a fall of one inch of rain is distributed over 1 hour and another inch at another place on the same day over 24 hours, the effects of the rain must generally vary, in the first instance $\frac{1}{2}$ to $\frac{9}{10}$ths of the water that reached the surface of the soil would, according to its nature, flow off the ground, whereas in the latter case the whole may, under favorable circumstances, pass into the soil. To this it must be added that the first mentioned 1 inch of rain will beat down the soil and render it otherwise unfavorable to the growth of plants. In both cases 1 inch of rain would be registered in one day.

3. It is generally assumed that light showers of rain are more beneficial than heavy ones; this however can only be true to a certain extent. A light shower of rain is very beneficial to growing crops especially when the same cover the ground, to prevent rapid evaporation, but will fail altogether to have any effect on unploughed soil during the hot season. If during this time a shower of rain amounting to 0·1 or 0·15 falls in the early morning and is succeeded by a bright hot day, by the evening of the same day every trace of moisture will most probably be obliterated; and such an amount may even fall every morning during 10–12 consecutive days with no better results; whereas if the amount of rain that was distributed over ten or twelve days were precipitated during one day only, the effect would be much more favorable; the moisture in the soil would then suffice to admit of field operations being carried out and the soil would thereby be qualified to benefit more from subsequent small showers of rain.

4. *Season.*—The year under report was not favorable for the Farm, the total rainfall registered on the Farm was only 33·16 inches, the average of the previous ten

years being 51·12 inches. The bad effects resulting from this deficiency of rainfall were much intensified by its unfavorable distribution. Nearly half of the total amount of the rain (15·61 inches) fell at a time when it could have but little good effect on the crops, except to provide food for live-stock. The rain coming too late to admit the sowing of hot weather crops and too early to put down cold weather crops. From the register it will be seen that the rain in April was 0·67 inch, which is rather more than the usual fall during that month. Rain fell in May on five days; the total amount being 3·9 inches; it fell in slight showers except one fall of 1·65 inch, of which 1·5 inch was precipitated in less than one hour and consequently much of the water drained off the land. The rain that fell during this month enabled field operations to be begun but was insufficient for sowing the hot weather crops. During June only 0·1 inch of rain was registered; the average of the previous ten years being 3·40 inches: had there been some showers of rain during the early part of this month, gingelly, cumboo and other hot weather crops could have been put down, as it was, the traces of the rain that fell in May were entirely obliterated by the end of the first week in June, and the soil became so dry that all cultivation was stopped. In the month of July 3·32 inches of rain fell, which, although less than usual, was very effective, because well distributed; there were seven rainy days; the heaviest fall being 1·05 inch, which occurred on the 1st of the month and was followed by 0·45 inch on the 3rd and 0·55 inch on the 5th. These 2 inches of rain moistened the ground to such an extent that field operations could be resumed: it being too late for sowing regular hot weather crops, a considerable area of land was put under horsegram and 60 days cumboo. Of all the crops put down, those sown during the month of July had the best chance of success. The rainfall in August amounted to 6·12 inches, the average of the previous ten years being 4·61 inches, the comparatively large amount of rain which fell during the month was very advantageous; the rain was distributed over ten rainy days and fell in gentle sho wers except on one day. The rainfall in September amounted to 6·02 inches and was distributed over fourteen rainy days. The weather was favorable during this month although rather a little too wet for sowing during the first half.

5. In October the rainfall amounted only to 7·02 inches, which was distributed over nine rainy days, nearly all of which were during the first half of the month. The weather continued favorable until the 18th of the month from which date the dry weather season may be said to have commenced; the bright days and powerful sun which prevailed predominating from this date gave the latter end of this month more the character of a hot season month than of a cold one; the evaporation from the soil was intense and the crops suffered from drought at the end of the month. At the commencement of November, a good shower of rain greatly revived the crops and gave them a fresh start; its effect however did not last long and the few showers that fell during the latter part of the month were too light to be of much use for the wants of the crops; some of which became so much stunted as not to revive afterwards. The total amount of rain that fell in November was only 1·19 inch, the average of the previous ten years being 13·16 inches. The deficiency of the rainfall in this month was disastrous in its effects on the Farm; not only were the cold weather crops so much stunted and weakened as to become a prey to the attacks of fungoid diseases and insects, but other crops, which are usually put down during or after the heavy rains, could not be sown at all. Paddy sown on the irrigable land in the northern part of the Farm, which depends for water on the Mylapore Tank, failed on account of the tank being entirely dry and remaining so the whole year; the wells resorted to afterwards ran dry.

6. The rainfall in December was 2·05 inches, which is but little more than half the average fall of the previous ten years. The fall of 1·55 inch on the 1st of December would have had a good effect on the crops if they had not been stunted by the exceedingly dry weather of November. During January 0·72 inch of rain fell, which was distributed over four days; this rain was sufficient to cause the germination of pulses sown at the time, but did little else, as most of the crops succumbed soon afterwards. It had however some good effect on the Guinea-grass,

which was enabled thereby to grow steadily and thus to provide some grazing for the sheep. No rain fell in February. During March 2·05 inches of rain were registered. This rain, being distributed over three consecutive days, did a great amount of good; it not only revived the Guinea-grass, which had stopped growing, but also benefited greatly the cotton and indigo crops. This rain was especially beneficial in its effect because it was followed by cloudy weather for several days, which prevented the rapid evaporation of the moisture from the soil. The soil was moistened to such an extent as to admit of tillage being commenced at a much earlier date than is usually possible, and thus our soils will have the benefit of a more thorough tillage than usual during the coming season.

7. The following table shows the monthly rainfall of the year compared with the average of the previous ten years' rainfall:—

Months.	1878-79.		Average of ten years.	
	Rainfall.	Wet days.	Rainfall.	Wet days.
April	0·67	2	0·33	·5
May	3·90	5	3·75	1·5
June	0·10	1	3·40	6·1
July	3·32	8	4·33	8·8
August	6·12	10	4·61	9·1
September	6·02	14	5·83	8·3
October	7·02	9	10·55	10·9
November	1·19	5	13·16	12·3
December	2·05	7	3·52	4·6
January	0·72	4	0·60	·9
February	...	...	0·89	·6
March	2·05	3	0·15	·5
Total ...	33·16	68	51·12	64·1

8. In the next statement the weekly rainfall is shown with the average weekly rainfall of the previous ten years:—

Weeks.	1878-79.		Average of the previous ten years.		Weeks.	1878-79.		Average of the previous ten years.	
	Rainfall	Wet days.	Rainfall	Wet days.		Rainfall	Wet days.	Rainfall	Wet days.
1st Week ...	...	...	·22	·2	27th Week ...	4·62	4	1·50	2·0
2nd do. ..	...	...	·01	·1	28th do. ...	1·62	1	1·71	1·7
3rd do. ...	·67	2	...	...	29th do. ...	·78	4	3·27	3·2
4th do. ...	..	...	·01	·1	30th do. ...	...	...	2.84	3·0
5th do. ...	·10	1	1·41	·5	31st do. ...	·97	1	2·15	2·3
6th do. ...	...	...	·11	·3	32nd do. ...	...	...	2·91	2·8
7th do. ...	2·10	2	2·25	·5	33rd do. ...	...	...	3·14	3·3
8th do. ...	1·70	2	·03	·2	34th do. ...	·12	3	3·22	2·7
9th do. ...	...	...	·08	·3	35th do. ...	1·65	2	3·78	2·8
10th do. ...	...	...	1·16	1·2	36th do. ...	·80	2	1·21	1·2
11th do. ...	...	...	1·38	1·9	37th do. ...	·09	2	1·13	1·7
12th do. ...	...	...	·27	1·2	38th do. ...	·33	2	·29	·5
13th do. ...	·10	1	·50	1·6	39th do. ...	...	...	·07	·8
14th do. ...	2·05	3	0·34	1·0	40th do. ...	·05	1	·00	·1
15th do. ...	...	...	1·24	2·2	41st do. ...	·35	1	·00	·1
16th do. ...	·80	2	·87	2·2	42nd do. ...	...	...	·59	·6
17th do. ...	·47	2	1·26	2·7	43rd do. ...	·32	2	·01	·1
18th do. ...	1·14	3	1·34	2·1	44th do. ...	...	...	...	...
19th do. ...	·63	2	1·29	2·5	45th do. ...	...	...	·69	·5
20th do. ...	3·88	3	·94	2·2	46th do. ...	...	...	...	...
21st do. ...	·47	2	·87	1·5	47th do. ...	...	...	·12	·1
22nd do. ...	1·17	1	1·24	2·0	48th do. ...	...	...	·14	·2
23rd do. ...	3·06	4	1·28	2·4	49th do. ...	...	...	·08	·4
24th do. ...	1·04	5	1·10	1·6	50th do. ...	...	...	...	...
25th do. ...	·15	1	1·59	1·7	51st do. ...	2·05	3	...	...
26th do. ...	·60	3	1·27	1·7	52nd do. ...	...	...	...	...

9. The following table shows the daily rainfall during the year :—

Date.	April 1878.	May 1878	June 1878.	July 1878.	August 1878.	September 1878.	October 1878.	November 1878.	December 1878.	January 1879.	February 1879.	March 1879.
1	...	...	...	1·05	·37	1·17	·72	...	1·55	...	...	...
2	...	...	...	...	·26	·37	·15	·97	...	...	...	...
3	...	·10	...	·45	·51	...	...	...	·03	·05	...	...
4	...	...	...	...	...	...	·70	...	·05	...	...	...
5	...	...	...	·55	...	·01	...	...	...	...	...	...
6	...	...	...	...	...	2·21	3·05	...	...	...	...	...
7	...	...	...	...	...	·47	1·62	...	...	...	...	...
8	...	...	...	...	·53	...	...	...	...	...	...	...
9	...	...	...	...	...	·15	...	...	...	...	...	...
10	...	...	...	...	...	·20	...	...	·02	...	...	...
11	...	...	...	...	·10	...	...	...	...	...	...	
12	...	...	...	...	·29	·25	...	...	...	·35	...	...
13	...	...	...	...	·57	·05	...	...	...	...	...	...
14	...	·45	...	...	3·02	·39	·14	...	...	...	...	...
15	·20	1·65	...	...	...	...	...	...	·07	...	...	...
16	...	...	...	...	...	...	·17	...	...	...	...	...
17	·47	...	...	...	...	·15	·45	...	...	...	...	...
18	...	...	...	...	...	...	·02	...	...	...	...	...
19	...	...	...	} ·75	{ ...	...	...	...	·05	...	...	...
20	...	·70	...		{ ·02	...	...	·01	·28	...	...	0·30
21	...	...	...	·05	...	...	...	...	...	...	...	1·25
22	...	...	...	·15	·45	...	...	...	...	·27	...	0·50
23	...	...	...	·32	...	...	...	·01	...	·05	...	...
24	...	...	...	...	...	·08	...	·10	...	...	...	...
25	...	...	...	...	...	...	...	·10	...	...	...	...
26	...	1·00	...	...	...	·25	...	...	...	...	...	...
27	...	...	...	...	...	...	...	...	...	...	...	...
28	...	...	·10	...	...	·27	...	...	...	...	...	...
29	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...	...	...
31	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	·67	3·90	·10	3·32	6·12	6·02	7·02	1·19	2·05	·72	Nil.	2·05

10. The following table shows the daily rainfall from 15th of October 1878 up to 31st of December 1878 compared with the average rainfall of the previous five years for the same period :—

Date.	October.		November.		December.	
	1878-79.	Average of previous 5 years.	1878-79.	Average of previous 5 years.	1878-79.	Average of previous 5 years.
1 ...	...	...	...	...	1·55	1·44
2 ...	...	...	0·97	0·52	...	0·70
3 ...	...	...	...	0·02	0·03	0·37
4 ...	...	...	...	...	0·05	0·06
5 ...	...	...	...	...	...	...
6 ...	...	...	...	0·09	...	0·33
7 ...	...	...	...	...	...	0·06
8 ...	...	...	...	0·24	...	0·03
9 ...	...	...	...	0·65	...	0·11
10 ...	...	...	...	1·08	0·02	...
11 ...	...	...	...	0·27	...	0·17
12 ...	...	...	...	0·12	...	0·51
13 ...	...	...	...	0·24	...	...
14 ...	...	...	...	1·17	...	0·35
15 ...	...	1·2	...	0·97	0·07	0·08
16 ...	0·17	·68	...	0·35	...	0·05
17 ...	0·45	·10	...	0·30	...	...
18 ...	0·02	·05	...	0·22	...	0·10
19 ...	...	·06	...	0·17	0·05	...
20 ...	...	·30	·01	...	0·28	...
21 ...	...	·29	...	0·54	...	...
22 ...	...	·14	...	0·32	...	...
23 ...	...	·83	·01	0·66	...	...
24 ...	...	1·53	·10	...	...	0·02
25 ...	...	·71	·10	0·15	...	...
26 ...	...	·28	...	0·34	...	...
27 ...	...	·20	...	0·73	...	...
28 ...	...	·10	...	0·12	...	0·02
29 ...	...	·21	...	0·35	...	...
30 ...	...	1·51	...	0·88	...	...
31 ...	...	·07	...	...	...	...
Total ...	0·64	7·18	1·19	10·44	2·05	4·40

11. *Fungoid Diseases.*—The peculiarities of the season were very favorable to the development of rust. The drought that commenced at the latter end of October checked the growth of plants and predisposed them to the attacks of the disease. The parasite attacked all the yellow cholum, white cholum, and Planter's friend crops. It appeared first in a crop of yellow cholum raised from seed obtained from Bellary. Most probably in Bellary the seed was raised under conditions differing considerably from those it met with on the Farm; so that the crop grown here had not only to contend against an adverse season, but had also to adapt itself to the soil, &c.; circumstances which reduced the power of the plants for resisting the inroads of the parasite and predisposed them to disease. The germs of the fungus may have been in the soil, brought there probably with the manure; it being well known that when straw that has been attacked by rust is used as cattle food or bedding, the parasites may be propagated by using the manure for cereal crops, if the conditions affecting its growth are favorable.

12. A crop of white cholum on a plot adjoining the last named was soon afterwards attacked; to this field the germs were most probably carried by the wind from the diseased yellow cholum field. The crops in the two fields were so severely attacked that the plants were entirely covered with the red powder and soon afterwards withered, dried up, and died before they were fully developed. The white cholum did not come into ear, so that no grain was obtained, and the straw also had lost much of its value as fodder for cattle.

13. Neither smut nor ergot were noticed during the year.

14. The cholum seed sown was all dressed with sulphate of copper at the rate of 4 ounces per 100 lb. of seed. The dressing with sulphate of copper which

destroys the spores of the smut is of course ineffective against the attacks of rust, the spores of this parasite not being adherent to the grains.

15. *Insect attacks.*—Almost all the cholum crops that had been attacked by rust were afterwards attacked by insects. The insect was a small fly which deposited its egg inside the covering leaves; the number of these flies increased so rapidly that in a few days the plants, which were first covered with rust, became whitened by the covering of insects. The degeneration of the sap was most probably the active cause of the insect attack. The insects attacked the straw only when it was nearly dry.

16. Some of the tobacco grown on the Farm was also attacked by insects. In this case the pest was a small green beetle. The peculiarity of its attack was that it commenced its ravages on the bottom leaves where the stalk springs from the main stem, and from that place rapidly extended its attacks to the higher part of the bottom leaves, and after having destroyed them worked up the plant until the whole was ruined. The plants were covered by a black powder, which, when removed in the first stage of the attack, exhibited the leaf in its normal green state, but when left for a few days, caused the withering of the leaf.

The plants that were raised from Farm-grown seed, which were acclimatized and appeared the most healthy and vigorous, were very little injured. This may be due to the fact that these plants were not so much predisposed to attack on account of their vigor, or because they were more advanced towards maturity and therefore contained more nicotin and consequently yielded a less palatable food for the insects.

17. *Vermin.*—The number of snakes is decreasing every year on the Farm. When going over the land five years ago, snakes might frequently be seen, but now it is a rare occurrence to meet with one. Squirrels, which in previous years made considerable havoc in the cotton fields, have also greatly decreased in number. This is probably chiefly due to the persistent efforts made in killing them down. The number of rats, however, seems greatly to have increased. They did great damage in some fields, especially in the Botanical Garden, where they several times destroyed experimental crops. They were especially destructive to maize crops by exhuming the seed soon after it had been sown. The increase in the number of rats may be partly due to the lesser number of snakes on the Farm, but the great increase in the number of rats last season was a cause of complaint in many parts of the Presidency.

During the past year rewards have been paid for the destruction of—

Cobras	8
Other snakes	130
Squirrels	179
Rats	1,602

18. *Office Work.*—During the year the work was further increased in the Farm office. The number of letters written during the past year was—

Departmental	222
General correspondence	498

19. *Establishment.*—No changes took place in the Farm establishment during the year; and the conduct of all the members of it was on the whole satisfactory.

SECTION II.

CULTIVATION AND CROPS.

20. *Rotations.*—The rotation of crops in field No. 3, referred to in paragraph 16 of last year's report, has been adhered to, the field being sown on the 29th October 1879 with cotton and maize in the usual way. The cotton seed germinated very well, and the plants

First year's cropping.

appeared evenly over the whole field, but the maize plants, the seed of which had been newly imported from America, came up very scantily, and the few plants that appeared did not thrive well, apparently owing to the heat of the sun: had there been a regular cold weather season, the crop would most probably have succeeded. After the American maize had failed, the ridges sown with it were ploughed up and country maize was sown; but this also did not succeed, it being too late to raise a cold weather crop without the aid of irrigation. The cotton however did very well and promises to yield fairly.

Partial failure of first crop.

21. In the rotation referred to in paragraph 17 of last year's report, owing to the unfavorable character of the weather, the raggy did not germinate evenly over the whole field, and although the blanks were resown, the yield was very low. The castor beans, however, germinated very well and the plants appeared evenly over the whole field; they grew luxuriantly until December, when their growth was checked, and they were only able to struggle on until February, when they commenced to die off gradually. The bearing period being so very short, the outturn was only 690 lb. of beans from the whole field. Had not the monsoon rains failed the plants would have grown much larger and the flowering and seeding season instead of ceasing in December, would, in all probability, have continued until May or June, as in previous years, and the outturn consequently have been much heavier.

Re-draining rendered necessary.

22. *Drainage.*—The drains of the plot drained in 1875 were opened in June last, and the pipes examined to ascertain the exact state they were in; it was found that most of the pipes were more or less silted up. The plot, which measures 7,100 square yards or a little less than $1\frac{1}{2}$ acres, and constitutes a portion of field No. 21, is situated at a very low level; and owing to the treatment the land had undergone at the hands of the ryots who formerly held it, the physical conditions of the soil were rendered so bad that nothing would grow on it. To reclaim the land draining was resorted to; but the prospect of success was not very great, owing to the peculiarity of the soil and the low situation of the land. The subsoil consists chiefly of fine sand which, after the drains had been dug, was constantly driven into them by the water in forcing its way into the drain. The drains were allowed to remain open for several weeks before the pipes were laid to get rid of the water, which was oozing out from their sides, but it was impossible to get them dry and to obtain a firm bed for the pipes. The workmen from their inability to work with draining tools had to stand in the drains when digging them and when laying the pipes, and thereby made the matter worse. Indeed the soil at the bottom of the drains had in some places more the consistency of a paddy bed fit to receive seedlings than that of a soil ready to receive drain pipes. A layer of clay turf which was laid at the bottom of the drains to serve as a bed for the pipes could only partly neutralize the bad effects of the marshy bottom. This caused the pipes to sink unevenly and to become deranged in their junctures, thus allowing the ingress of soil.

Difficulties in laying pipes.

Small amount of fall available.

23. Bad though the execution of the work was it would not have been sufficient to ruin the drainage in so short a time, had it been possible to give a great fall to the pipes, but unfortunately little fall was available; the surface of the field being nearly level and only a few feet above the bed of the nullah into which the water was discharged. If the trenches could have been left open for some months longer, until they had run dry, a somewhat firmer bed for the pipes would have been obtained, but this practice, which in similar cases is often resorted to in Europe, cannot well be adopted in this country, because showers of rain, which are here usually much heavier and therefore generally more destructive than in Europe, would not only cause the sides of the drains to fall in, but each drain by acting as an open surface water channel would quickly widen and assume the character of a nullah, whereby the field would be much injured.

Depth of drains.

24. The pipes used were manufactured on the Farm. For the parallel drains 2-inch pipes and for the main drain pipes measuring 4 inches in diameter were used. The depth at which the pipes were

laid was from 3 feet to 3½ feet for the parallel drains, and from 4 to 5 feet for the main drain. As the field is nearly level the pipes were not laid so deeply at the upper end of the trenches as at the junction of the parallel drains with the main drain, in order to provide more fall. The distance apart at which the parallel drains were cut was 25 feet. The silt probably got into the pipes after the occurrence of the first heavy rain after they were laid.

Improved texture of the soil.

25. A striking improvement in the physical condition of the soil was, however, observed when the drains were opened. The soil, which before was of close texture, had become more open and friable and indicated great amelioration. The subterranean water level was only about 1 foot lower than the level of the pipes, yet in most places the soil near the pipes appeared well aërated and free of any superabundance of water. Indeed the soil taken out from the drains had the appearance of one which has been subjected to tillage for a long time. The reopening of the drain which caused so much labor in the first cutting was a comparatively easy task; this time no water being met with at any place.

Plan adopted on re-draining.

26. As there were indubitable signs of the possibility of improving the land by drainage it was decided to redrain the land. To avoid the cause of the previous failure, a greater fall was given, which necessitated, however, the making of the outfall of the main drain at rather too low a level. The top end of the drains was not sunk so deeply as before. By this means it was possible to give the main drain a slope of 2 feet per 1,000 and the parallel drains a fall of 3½ feet per 1,000. To prevent the unequal sinking of the pipes and also, as far as possible, the ingress of soil, the junctures of the pipes were covered with collars each 4 inches long; and three deposit cisterns were built in the main drain to catch the silt, if any should enter the pipes; moreover the proper junction of parallel and main drain was effected by using junction pipes, that is, pipes which have the first branching pipe of the parallel drain fixed to the pipe of the main drain. The pipes of the parallel drains were made to branch off from that of the main drain from the top and not from the side as it is often the practice; by this means the earthy matter in suspension will not be deposited when entering the pipes of the main drains, because the water on falling down into the pipe of the main drain attains thereby sufficient velocity to prevent any silting. When re-draining the land the old drains were used, which however had partly to be filled and the pipes previously used were again laid. The work was carried out by day labor; in opening the drains one cooly could easily dig a drain 100 feet long 3½ feet deep in a rough manner. The following exhibits the cost of re-draining the land, exclusive of the cost of pipes :—

Cost of the work.

	RS.	A.	P.
Opening of 3,000 running feet of drain trenches, and filling drain ...	10	15	6
Building one outfall and three cisterns 6 feet deep—			
20 parahs of lime	5	14	0
200 large bricks	3	0	0
3 shutters	2	0	0
Bricklayers' labor	7	8	7
Cart-hire for bricks, sand, &c.	1	0	0
Total Rs. ...	30	6	1

which is at the rate of Rupees 20 per acre. The charge for labor is certainly very moderate; the cost being only 2·1 pies per running yard, in Germany the price paid for draining 6–7 feet deep being 15 pies per running yard. It must however be borne in mind that the soil was in a very favorable state for digging and the weather very fine.

Value of deposit cisterns.

27. That the construction of deposit cisterns in the main drain was not superfluous was shown after the first heavy shower of rain; on the 6th October 3·05 inches of rain fell when it was found that the deposit accumulated measured about a foot in depth in each cistern; in one

the deposit was so great that it filled the cistern to a much higher level than that of the pipe. The silt was removed, and no soil has been deposited since that time.

28. The drainage made in 1873, referred to paragraph 18 of the last report, was found in a similar state to that mentioned above; the pipes being all more or less silted up. Although the pipes were silted up, it was, however, repeatedly observed during the year that the main drain discharged a considerable amount of clear water. This is probably owing to the formation of water-courses near the pipes by means of which the under water is conveyed through the drains and discharged at the outfall.

29. *Trench-ploughing.*—The weather being favorable during August and September for field operations, nearly all the land prepared for cold weather crops at that time was ploughed to a depth varying from 9 to 14 inches. It was found that some of the ploughs obtained from Sweden of the English model are admirably adapted for deep ploughing, and they were nearly exclusively used for this purpose; indeed they were almost the only ones that could be effectively used, especially at a time when the soil had become dry and hard. Some of the ploughs turned a furrow 14 inches wide and 12 inches deep, thus moving 13 cubic yards of soil in every 100 yards travelled. The draught was necessarily heavy, and commonly two pairs of cattle were used, except when the pair of buffalo bulls were used, which on account of their great strength were able to do the work by themselves. Sometimes the soil was so hard that the light iron ploughs could not penetrate into the soil and even a subsoil plough following these ploughs did not make good work, but, on using the heavy ploughs referred to with two pairs of cattle, the hard pan lying a few inches below the surface was broken through and a moist subsoil was sometimes turned up; in this case one deep ploughing effected more than two or three ploughings with a light plough.

Value of heavy ploughs in dry weather.

30. These ploughings no doubt were very beneficial to the land, but the effect on the first crop grown was not always good. At other times after a shower of rain, when the surface was too wet for ordinary ploughing, by ploughing deeply a drier soil was turned up from below, which on being mixed with that on the surface produced a sufficiently moist seed bed, and a soil dry enough to admit other operations, such as harrowing, &c., being performed. By this means not only could sowing be earlier effected than would have been possible had the land not been so deeply ploughed; but the moisture thus distributed through a great body of soil was more fixed, it being well known, and has been shown in experiments made with various soils on this Farm, that the rate of evaporation is much greater from a soil saturated with water than from one which is only moderately moist.

Benefits of proper ploughing.

31. There can be little doubt that the comparatively good yield of some of the crops raised last year under the adverse circumstances previously referred to must be chiefly attributed to deep ploughing, especially in cases where the subsoil had been in a measure prepared for it, by subsoil ploughing and heavy manuring in previous years. The beneficial effect of it was most strikingly exhibited in field No. 33, which had been twice deeply ploughed, in which a crop of horse-gram was sown on the 16th January. The seed germinated freely and the plants grew luxuriantly all over the field, except at the head lands, which had been less deeply ploughed, and the soil of which had been more or less consolidated by the frequent treading of cattle. Close by another field which had not been so deeply ploughed was sown with horse-gram at the same time. The seed in this case also germinated regularly but the plants ceased growing and perished soon after they appeared above ground on account of the insufficiency of moisture.

Value of deep cultivation still further demonstrated.

32. That a deeply stirred soil condenses and retains more water than one only moved to a slight depth was repeatedly observed on this Farm during the year. Land that had been once deeply ploughed could be easily ploughed subsequently during the dry season, and the soil in these cases was much more friable and

contained much more moisture than the soil of fields that had not been so deeply ploughed.

33. Caution should however be exercised in adopting deep ploughing; thus—land whose surface soil is poor, and having a subsoil poorer still and which cannot be enriched by a liberal supply of manure; and again soils, which contain much clay, or whose subsoil contains much iron in the form of protoxide, may be rendered barren for considerable length of time by adopting *deep ploughing* suddenly. The soil on this Farm is mostly of a sandy or sandy-loamy character and may generally, without running great risk, be ploughed deeply; the porous soil admitting easy access of atmospheric air is easily ameliorated, especially when liberally manured. The surface soil being however generally richer than the subsoil in the case of the partially improved soils, by ploughing it down temporary loss may be incurred.

Caution to be observed in deep ploughing.

34. "Liberal manuring" is the key to success, and when adequate supplies of manure are available deep ploughing on such a soil may be adopted without fear. On the whole there is less risk of injuring the land by deepening the furrow by means of the subsoil plough than by trench-ploughing. Especially for salt lands the value of deep subsoil ploughing cannot be overrated; for if the soil is made very loose to a great depth the capillary tubes become so large that the injurious salts are unable to rise to the surface; and those also which may be in the surface soil will be washed down into the subsoil thereby rendering the surface soil fit for the growth of plants.

Subsoiling the safest plan.

UNIRRIGATED CROPS.

35. The following table shows the yield of crops raised last year without the aid of irrigation. It is to be seen that some of the crops yielded fairly, considering the unfavorable season experienced.

Number.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.	
				Date.	Amount of Seed sown.	Seed sown per Acre.	Date.	Outturn.					Inches.	Wet Days.
								Grain or Seed.	Straw or Fodder.	Grain per Acre.	Straw per Acre.			
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
	Cereal Grain Crops.													
1	Yellow cholum	15-I. ...	4·1	12th October 1878 ...	73	17·8	15th February 1879 ...	1,775	24,709	433	6,027	126	4·74	20
2	Do.	15-II. ...	3·2	15th October 1878 ...	123	38·4	20th February 1879 ...	783½	18,392	244	5,748	128	4·60	19
3	Sorghum saccharatum ...	18 ...	4·82	14th October 1878 ...	95	19·7	17th February 1879 ...	2,038	26,566	423	5,509	126	4·60	19
4	Planter's friend	17 ...	1·93	10th October 1878 ...	45	23	4th February 1879 ...	1,216	22,168	680	11,486	117	4·74	20
5	Raggy	16 ...	2·41	17th September 1878 ...	44	18	25th December 1878 ...	60	1,830	25	759	99	11·01	25
6	Cumboo	21-*a* ...	1·5	19th July 1878 ...	30	20	20th September 1878 ...	338	10,920	225	7,280	71	31·41	28
	Cereal Fodder Crops.													
7	Planter's friend	17 ...	2·37	10th October 1878 ...	55	23	14th December 1878 ...	...	11,780	...	4,970	65	3·62	13
8	Yellow cholum	34-*a* ...	1·87	16th October 1878 ...	50	26	28th December 1878 ...	...	24,880	...	13,305	73	3·71	14
9	White cholum	32 ...	4·25	3rd October 1878 ..	95	22	18th January 1879 ...	...	36,537	...	8,597	107	9·79	21
10	Do.	10-*b* ...	2·18	18th September 1878 ...	50	22	8th November 1878 ...	...	6,780	...	3,110	51	8·59	13
11	Do.	10-*b* ...	2·18	9th November 1878 ...	50	22	1st March 1879 ...	...	27,190	...	13,199	112	3·96	15
12	Sorghum saccharatum ...	10-I. ...	2·128	10th September 1878 ...	50	23	11th November 1878 ...	...	22,537	...	10,590	62	9·43	17
13	Tenney and dholl	11-*b* ...	2·66	16th October 1878 ...	73	27	8th December 1878 ...	...	11,315	...	4,254	53	3·29	10
14	Guinea-grass	27 ...	2·11	4th November 1878 ...	...	...	31st January 1879 ...	...	3,780	...	1,791	88	2·99	15
15	Do.	23-*a* ...	5·96	2nd November 1876 ...	...	...	5th October 1878 ...	20	7,830	3	1,314	702	91·2	125
16	Do.	3 ...	1·78	...	...	...	2nd July 1878 ...	...	4,100	...	2,303	...	...	...
	Leguminous Pulse Crops.													
17	Black gram	19-*b* ...	1·18	3rd December 1878 ...	18	15	25th February 1879 ...	49	1,160	42	983	84	1·19	9
18	Horse do.	19-*b* ...	1·18	3rd December 1878 ...	48	40	15th March 1879 ...	107	1,216	91	1,031	102	1·19	9
19	Black do.	25 ...	1·68	19th October 1878 ...	54	32	19th February 1879 ...	85½	1,140	51	679	113	3·96	16

Number.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.	
				Date.	Amount of Seed sown.	Seed sown per Acre.	Date.	Outturn.					Inches.	Wet Days.
								Grain or Seed.	Straw or Fodder.	Grain per Acre.	Straw per Acre.			
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
	Leguminous Fodder Crops.													
20	Horse-gram and cumboo ...	13 ...	2·73	19th July 1878 ...	70	25	20th September 1878 ...	...	25,473	...	9,330	63	12·81	25
21	Do. do. ...	14 ...	3·47	5th July 1878 ...	77	22	18th September 1878 ...	...	28,960	...	8,346	75	13·36	26
22	Horse-gram	15-*a* & *b*.	7·30	30th July 1878 ...	161	22	18th September 1878 ...	...	59,130	....	8,100	69	12·81	25
23	Do.	17 ...	4·90	12th July 1878 ...	92	19	11th September 1878 ...	...	24,500	...	5,000	61	11·97	21
	Fibre and Dye Crops.							Seed cotton		Seed cotton				
24	Cotton	10 ...	2·12	10th September 1877 ...	39	18	1st July 1878 ...	1,215	...	591	...	294	38·41	45
25	Do.	33 ...	4·75	1st September 1877 ...	20	5	1st July 1878 ...	1,386	...	291	...	277	42·14	50
26	Do.	1 ...	·95	26th September 1878 ...	7	7	...	...	...	...	...	...	13·30	29
27	Do.	3 ...	1·78	28th September 1878 ...	20	11	...	...	...	...	...	...	13·03	28
28	Do.	4-I ...	3·18	12th September 1878 ...	25	8	...	...	...	...	...	...	14·22	34
									Bundles.		Bundles.			
29	Indigo	16 ...	4·82	26th November 1877 ...	32	6	28th February 1878 ...	...	291	...	60·37	94	3·46	7
							21st May 1878 ...	...	83	...	17·22	82	3·57	6
							14th August 1878 ...	...	201	...	41·70	85	10·07	17
30	Do.	32 ...	4·25	27th November 1877 ...	58	13	7th March 1878 ...	...	211	...	50	100	3·46	7
							21st May 1878 ...	...	218	...	51	75	3·57	6
							7th August 1878 ...	...	339	...	80	78	3·56	11
31	Do.	14 ...	3·47	5th December 1878 ...	80	23	5th March 1879 ...	...	72	...	20·7	90	1·14	8
	Oil Seed Crop.													
32	Castor beans	16 ...	2·41	17th September 1878 ...	30	12	24th February 1879 ...	690	...	286	...	160	11·58	28

36. *Yellow Cholum, Nos.* 1 *and* 2.—These crops were raised in the field referred to in paragraph 31 of the last report, it produced a very good crop of horse-gram which was ploughed in as a green manure shortly before the cholum was sown. The outturn of grain, 433 lb. per acre, from No. 1 is good, considering the adverse season during which the crop grew, the rainfall being only 4·74 inches, and the sky was nearly always clear and bright from the very commencement. The yield however would have been much greater had the vitality of the seed been better; the plants appeared unevenly over the ground, and the crop was patchy in several places, especially in those that had been stripped of the surface soil to a considerable depth. The individual plants were however very well developed over nearly the whole area: the stalks were very thick and many of the heads attained an extraordinarily large size. The grain was generally small; this was evidently due to the insect attack with which the crop suffered; most of the heads being very close harboured a great number of insects. It was observed that the grain in the heads that were most attacked exuded a glutinous substance before they matured; this caused them to shrivel more or less when ripening, thereby reducing the yield. The plot on which No. 2 grew having been made up of portions of several fields, including a road, is of very varied quality and part of it is in very low manurial condition. The horse-gram crop was also ploughed in as manure in this plot as in plot No. 1. The outturn, 244 lbs. per acre, is low: this is chiefly due to the poverty of the soil and perhaps in some measure to the different mode of interculture adopted. The seed in plot No. 1. being sown in lines alternately 6 and 24 inches apart, admitted of the use of the plough, instead of the horse-hoe for cultivating between the rows, but although this system is more economical, it is doubtful whether it is in all cases advantageous.

Good crop with small rainfall.

37. On plot No. 2 some experiments were made to ascertain the best distance apart at which to sow this crop; and the results are given below:—

Number.	Seed sown in lines.	Outturn.			
		Average for 2 Plots.		Per Acre.	
		Grain.	Straw.	Grain.	Straw.
		LB.	LB.	LB.	LB.
1	9 inches apart	67	1,461	322	6,957
2	12 do.	69	1,278	328	6,085
3	18 do.	61	1,404	294	6,686
4	24 do.	63	1,274	303	6,086
5	Alternately 6″ and 18″ apart ...	64	1,265	305	6,026
6	Broad-cast	26	1,040	123	4,952

In every case the plots were duplicated; the average outturn is given and by this means the errors likely to creep in from the varied nature of the soils of the field are in a measure neutralized; the area of the plots was ·21 acre. The figures tend to show that in a season like the past one, it is best on our soils to sow this crop in lines about 12″ apart; at this distance the highest yield of grain was obtained; but it is observable that the most valuable crop was obtained when the lines were placed only 9″ apart; however the greater economy of working, when the lines are only 12″ apart, more than compensates for the smaller yield. The relative values of the crop obtained per acre from plots Nos. 1, 2, and 3 were as follows:—

—	No. 1.	No. 2.	No. 3.
	RS. A. P.	RS. A. P.	RS. A. P.
Grain	10 11 9	10 14 11	9 12 10
Straw	23 3 0	20 4 6	22 4 7

From this it will be seen that the most valuable crop was most closely sown. It is however necessary to note that the duplicate plots presented great variance and in the

case of one plot sown in lines alternately 18 and 6 inches apart, the highest yield of grain of all was obtained.

Most striking however is the clear demonstration of the inadvisability of sowing such a crop broadcast. On the broadcast plot the yield of grain was scarcely more than one-third and that of straw a little more than two-thirds only of the yield from plot No. 1. The cost of hoeing the crop was also much greater in the case of this plot, as it all had to be done by manual labor. The value of the whole crop per acre in this case was only Rupees 20-12-8.

38. *Sorghum Saccharatum, No.* 3.—Grew in the field referred to in paragraph 25 of last year's report; the field however has been enlarged on its eastern side, and the soil of the piece added is of poor quality, consisting mostly of coarse sand. The outturn, 440 lb. of grain per acre, however, is fair. Had the crop grown on the head lands and on the piece newly added, where the crop was inferior, been separately calculated the figures showing the yield per acre of the remaining portion would be much more favorable. Great damage was also done to the crop by rats. As *Sorghum* does not ripen uniformly and the time of harvesting extends over several weeks, it is difficult to prevent entirely such losses.

39. *Planter's Friend, No.* 4.—This followed a crop of horse-gram, which had been ploughed in as green manure before the Planter's friend was sown. The field, No. 17, was levelled two years ago; the soil is poor and very variable, and all of it was in a very low manurial condition. The crop grew on the north-eastern portion of the field, the soil of which is rather better than the rest. The whole field had been sown with Planter's friend seed, but the plants grown on the more sandy soil being very much attacked by rust were cut for green fodder. The outturn of grain is very satisfactory, and it must be remembered that this was obtained from an inferior soil, with a rainfall of only 4·72 inches. The short time required to attain maturity is also worthy of notice.

40. *Raggy, No.* 5 *and No.* 32, *Castor beans*—Have already been referred to in paragraph 21.

41. *Cumboo,* No. 6.—This crop was grown on a soil consisting chiefly of fine sand and in low manurial condition: the outturn of grain is not heavy; it is however satisfactory as the crop was on the land only 71 days. A crop that can be raised in so short a time, although the outturn may not be very high is, as a hot weather crop, often of greater value than one that yields more heavily but requires a long time to attain maturity, on account of which it cannot be grown in fields that have to be prepared for the cold weather crops.

42. *Planter's Friend,* No. 7.—This was grown on the sandy portion of field No. 17 and was cut down early when the plants were not fully developed because they were severely attacked by rust. The outturn is consequently rather low.

43. *Yellow Cholum, No.* 8.—The outturn is very satisfactory, considering that the crop was only 73 days on the ground and the rainfall only 3·71 inches. The yield, however, would have been much heavier had the crop been cut before it was attacked by rust, which caused the drying up of the plants in the greater part of the field. The figures consequently represent more correctly the outturn of dry straw than of green fodder. The good outturn in this case was undoubtedly chiefly due to deep ploughing, for the yield of the head lands, that were much less deeply ploughed, was much less than that of the other parts of the field; the rust appeared also fully two weeks earlier on the crop grown on the head lands than elsewhere; and probably the disease spread from them over the plants growing on the remaining portion of the field.

44. *White Cholum, No.* 9.—This crop was very much attacked by rust and the straw was nearly half dry when it was cut, which accounts partly for the comparatively low yield. In some parts of the field the crop was very good, but the plants were very small on the head lands, this part of the land having been less deeply ploughed than the remainder. Under the shade of the tamarind trees the crop was also very inferior. The following table shows the yield of some of the better portion of the field as well as the outturn under the shade of a tamarind tree :—

—	Area.	Outturn.	Outturn per Acre.
	SQ. YDS.	LB.	LB.
Centre part of the field ...	100	528	25,355
Under the shade of a tamarind tree.	1,111	856	3,729

No. 10.—This crop was grown on soil which is a sandy loam and with reference to its physical qualities one of the best met with on the Farm, but is in low manurial condition. *No.* 11.—This was grown on the same plot as crop No. 10. The seed was sown a day after the preceding crop was harvested; the land, however, was deeply ploughed and well prepared by means of the harrow, &c. The outturn, 13,199 lb., is very good, considering the small rainfall and the bright sky predominating during the time of growth. The soil had evidently benefited by the interculture of the preceding crop and the deep ploughing before sowing.

45. *Sorghum saccharatum*, *No.* 12.—The outturn, 10,338 lb. per acre, is tolerably good. The field, however, is a good one, and the soil was well prepared; the weather was very favorable for the growth of crops. It is worth notice that the crop stood only 62 days on the ground.

46. *Tennay and Dholl*, *No.* 13.—This crop was sown on a soil of varied quality and was cut out before fully matured.

47. *Guinea-grass*, *No.* 14.—The land on which the crop grew is the more sandy portion of the field. The whole field was planted, but only the roots planted first, at a time when the sky was somewhat cloudy, struck root. The larger portion of the field failed entirely. The outturn, 1,791 lb. per acre, is satisfactory, considering the short time the roots have been put down and the little rainfall. A second crop was nearly fit for cutting at the end of March.

Nos. 15 *and* 16.—Only one cutting was obtained during the year, when a small portion was also allowed to run to seed from which 20 lb. of seed was obtained. The Guinea-grass, grown on these fields, afforded grazing for the sheep nearly throughout the whole year. The grass thus consumed has not been estimated.

48. *Black-gram and Horse-gram*, *Nos.* 17 *and* 18.—Grew on two different sides of the same field, the soil of which is throughout very poor, consisting chiefly of coarse sand; the crop however appeared healthy during the whole time of its growth, but the plants were all small, hence the low outturn. *No.* 19—was a crop produced on a very poor piece of land.

49. *Horse-grain and Camboo*, *No.* 20.—These crops were sown mixed, with the idea that the cumboo plants would afford support to the horse-gram and keep it off the ground. The outturn, 9,330 lb. per acre, is very good, considering that it was produced in only 63 days: the weather however was during the time very favorable.

No. 21.—This crop grew on a field part of which is in a very poor manurial condition; the outturn however is fair.

50. *Horse-gram*, *No.* 22.—This crop was grown in the same field as crops Nos. 1 and 2; the outturn, 8,100 lb. per acre, is certainly very satisfactory. The result was undoubtedly partly due to deep ploughing before sowing; the weather was also very favorable. The crop was ploughed in as green manure; the produce of a plot being weighed off and from this the outturn of the whole field estimated.

No. 23.—This crop was grown on the field which produced crops Nos. 4 and 7. The outturn was estimated.

51. *New Orleans Cotton*, *Nos.* 24 *and* 25.—These two crops were shortly referred to in paragraph 28 of last year's report. In the following table the yield of seed-cotton, as well as that of lint, is given:—

Month during which received.	Amount of Seed-cotton received from the Field.				Amount of Clean Cotton received.				Percentage of Clean Cotton and Lint obtained from Cotton in Seed.	
	No. 10 Field.		No. 33 Field.		No. 10 Field.		No. 33 Field.			
	Total in Month.	Percentage of Year's Crop.	Total in Month.	Percentage of Year's Crop.	Total in Month.	Percentage of Year's Crop.	Total in Month.	Percentage of Year's Crop.	No. 1	No. 33.
1877.	LB.		LB.		LB.		LB.			
December	1	·08	253·5	17·43	·25	·07	69	16·04	25	27·22
1878.										
January	...	...	201·5	13·86	...	...	57	13·25	...	28·29
February	...	...	10	·69	...	...	3·25	·76	...	32·50
March	268	22·27	361	24·82	79	21·98	115	26·74	29·48	31·86
April	440	36·58	170·5	11·72	146	40·62	46	10·69	33·18	26·98
May	89	7·40	134	9·21	26	7·23	44	10·23	29·21	32·84
June	371	30·84	294	20·21	98	27·27	87	20·23	26·42	29·59
July	34	2·83	30	2·06	10·16	2·83	8·87	2·06	29·88	29·57
Total ...	1,230	100·00	1,454·5	100·00	359·41	100·00	430·12	100·00	29·88	29·58

From these figures it will be seen that after June in neither case was any considerable portion of the crop obtained, thus confirming the belief that it is advisable to remove the cotton crop in July.

It will be remembered that the low percentage of cotton obtained in the early ginnings was explained by the fact that the cotton-in-seed when received from the field is, during the early months of the year, always charged with a considerable amount of moisture. The outturn from field No. 10, 169·5 lb. of lint per acre is good.

52. *No.* 26.—This crop was sown on a somewhat sour piece of land, where previously great difficulty has been experienced in producing good crops; the soil is of very close texture but appears to be tolerably well adapted to the growth of cotton. The plants commenced to bear at the beginning of February, the yield 177 lb. of seed-cotton per acre up to the end of March is satisfactory. The complete results will be given next year. The cholum that had been sown between the lines of cotton did not succeed; most probably on account of the soil being too sour.

No. 27.—The soil on which this crop was produced varies very much; in some parts it is stiff, in others more sandy; the field was never levelled and its surface has many depressions, so that after rain at a time when some parts of it are too wet, others are too dry for field operations. This drawback was remedied partly by subsoil drainage for a time, but the pipes having become choked up, the field has partially returned to its old state. The cotton plants did not therefore grow uniformly throughout the field and most of them attained only a small size. The outturn 189 lb. of seed cotton up to the end of March is, considering the drawbacks under which the crop labored, not bad. The result of this crop cannot be recorded fully this year.

No. 28.—This crop will be referred to fully under Section III, as some experiments were made in it with different manures. The results of the ginning, of the produce of the 3 crops last referred to, will be given next year.

53. *Indigo, Nos.* 29 *and* 30.—These crops were referred to in paragraph No. 30 of last year's report. It is noteworthy that the first cutting in field No. 16 was the heaviest, whereas in No. 32 the third cutting was the heaviest. The yield of both these cuttings was satisfactory, but the yield of the other cuttings, especially that of the second cutting in field No. 16, was very low. In general the yield of the second cutting is

Season a bad one for Indigo.

the best. The low yield of the second cutting in No. 16 was due to the land having been recently levelled and its soil being very poor; the dry weather in April and early part of May killed many plants; the heavy rain that fell during the latter part of May had a very beneficial effect for the third cutting in field No. 32, as on account of the soil being good none of the plants had died, but it did not very much affect the third cutting in No. 16 because many of the plants had died before the second cutting.

No. 31.—This crop followed a crop of cumboo and horse-gram fodder which followed one of *Sorghum saccharatum;* that referred to in paragraph 29 (No. 14) of last year's report. The soil of this field is rather varied and uneven in quality. That part of the field which had previously been a plantain garden yielded fairly at the first cutting but in some of the remaining parts the yield was very low. The results of this crop will be given fully next year.

IRRIGATED CROPS.

54. In the table given below the results of the crops grown by aid of irrigation are shown. The water was all raised by machinery.

Failure of the Mylapore Tank.

The Mylapore tank, from which irrigation water in ordinary seasons is obtained by gravitation for the paddy grown on the northern part of the Farm, was nearly dry throughout the whole year. This water under favorable circumstances lasts about seven months, so that by means of it two crops of paddy can be raised; but last year no water reached the Farm by gravitation. As there was a little water in the tank during the months of October and November some picottas were erected at the sluice to raise the water required to start the paddy crop. At that time it was expected every day that the monsoon would break and that the water in the tank would soon rise sufficiently high to flow to the paddy beds by gravitation; an expectation that was not realized. The little water in the tank was exhausted before the crops were half matured, and the single well available afterwards soon ran dry. The consequence was that, after expending about Rupees 100 for raising water, about ten acres of paddy withered; most of it yielding no grain at all and only a very poor outturn of straw for cattle fodder. In every case the irrigation was only occasional.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.	
				Date.	Amount of Seed.	Seed per Acre.	* Date.	Outturn.					Inches.	Wet Days.
								Grain.	Straw.	Grain per Acre.	Straw per Acre.			
	Cereal Grain Crops.		ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
1	Car paddy	35-*g*	·34	15th July 1878	Planted.		8th October 1878	181·5	2,503	534	7,362	85	19·65	34
2	Carolina paddy	36-*c*	·77	15th August 1878	Do.		4th December 1878	48	2,160	62	2,805	111	16·33	33
3	Seroomony paddy	37-*a*	·62	4th September 1878	15	80	3rd February 1879	57	3,680	92	5,935	152	15·46	37
4	Do.	35-*f*	·99	22nd August 1878	40	40	24th January 1879	224	1,786	226	1,804	155	17·00	39
5	Car paddy	R.F.-I.	·94	9th March 1878	Planted.		25th May 1878	324	1,624	409	1,728	77	3·57	6
6	Do.	R.F.-I.	·94	26th June 1878	Do.		10th October 1878	730	4,680	777	4,979	106	21·80	37
7	Do.	R.F.-II.	·66	16th February 1878	Do.		27th May 1878	226	1,400	342	2,121	100	4·57	7
8	Do.	R.F.-II.	·66	14th June 1878	40	60	10th October 1878	770	3,920	1,167	5,939	118	21·80	37
9	Madagascar paddy	35-II.	·60	18th October 1878	22·5	37·5	7th April 1879	111½	1,340	185	2,233	171	6·01	19
10	Ragi	35-I.	·35	19th do.	11	31	23rd January 1879	116	1,680	331	4,800	96	3·96	16
11	Maize	8	·28	17th do.	8	28	23rd December 1878	5,716*	2,232*	20,414	7,921	67	2·16	12
12	Do.	8	·61	31st December 1878	20	33	13th March 1879	9,200*	3,124*	15,082	5,121	72	2·77	7
	Cereal Fodder Crops.													
13	Yellow Cholum	8	·68	5th May 1878	60	88	18th September 1878		15,332		22,547	136	18·76	33
14	Do. (1st cutting)	12-*b*	·83	11th do.	50	69	31st July 1878		12,740		15,349	81	7·22	12
	Do. (2nd cutting)						30th September 1878		16,308		19,648	61	12·14	24
15	Do.	20-I.	·89	7th June 1878	60	67	24th August 1878		22,072		24,800	78	9·54	18
16	Do.	20-II.	·37	30th July 1878	35	94	31st October 1878		3,780		10,216	93	19·16	33
17	Do.	23-II.	1·5	20th do.	40	26	6th November 1878		17,977		11,985	109	21·40	33
18	Do.	35-II.	·6	18th May 1878	30	50	1st August 1878		9,812		16,353	75	5·49	11
19	Cumboo	22	1·75	25th do.	37	21	25th July 1878		7,303		4,173	61	4·42	9
20	Sorghum	12-*b*	·83	28th November 1878	25	30	1st March 1879		2,865		3,452	93	2·77	11
21	Car paddy	R.F.-*c*	·54	16th March 1878	32	59	17th June 1878		1,694		3,137	93	4·57	7
					Shoots.	Shoots.								
22	Sugarcane	1-*a*	·72	31st January 1878	5,000	6,944	29th January 1879		6,799		9,444	364	31·11	64
23	Do.	1-*b*	·72	30th March 1878	5,000	6,944	30th December 1878		6,696		9,300	275	30·39	60
	* *Vegetables and Fruits.*													
24	Plantains	12-*a*	1·68	19th September 1876	Planted.		31st March 1879		493†		293†	922	104·23	156
25	Sweet potatoes	4-3	1·25	7th September 1878	Do.		15th do.		2,451‡		1,966‡	189	12·77	34
26	Brinjals	11-*a*	·21	15th February 1878	Do.		4th June 1878		1,172§		5,582§	110	4·57	7
27	Do.	11-*a* & *b*.	·41	15th do.	Do.		3rd September 1878		1,122·5§		2,738§	200	15·66	28
28	Chillies	11-*c*	·13	16th March 1878	Do.		1st June 1878		72§		554§	77	4·57	7
29	Tobacco	8	·50	19th December 1878	Do.		3rd March 1879		...		...	...	...	...
30	Do.	8	·70	22nd February 1878	Do.		4th May 1878		1,016‖		1,450‖	195	17·35	40

* Cobs. † Bunches. ‡ Tubers. § Fruits. ‖ Dry leaf.

55. *Paddy—Nos.* 1 *to* 4.—These crops were grown on land, situated at the northern end of the Farm, which chiefly depends for its irrigation water on the Mylapore tank ; the low outturn of grain may be chiefly attributed to the tank having been empty throughout the year. Crops that required a long time to mature suffered most, and the yield was consequently low. Sirumoni paddy is often cultivated because it commands a higher price, and thus yields a higher return, but, as it requires a long time to mature, the cost of production is necessarily much greater than that incurred in raising a crop maturing in a shorter time. The Sirumoni paddy grown on the Farm required 152 days in one field and 155 days in another to reach maturity. The water required for irrigation was all raised by means of picottas. The cost of irrigating the crop in this manner for the long period was very great, greater indeed than the sum that would have been realized if a fine crop of paddy had been raised.

Nos. 5 *and* 6.—These crops were obtained from one field at different seasons. The outturn, especially of the first crop, is low; this may be chiefly attributed to the frequent cropping of the field and the low level of its surface. The field is badly drained, it being nearly at the same level as the river which constitutes its southern boundary.

Nos. 7 *and* 8.—These crops also were raised on the same land at two different seasons. The yield of the first crop was like that of the preceding case low, but the second crop was tolerably good. The land on which these crops were raised is situated east of the plot mentioned in the preceding paragraph and at the same low level. The paddy grown in the river-bed can be raised without undergoing a great expenditure for raising water, but there is a risk that the crop may be destroyed by being flooded whenever the river rises slightly. The land requires frequent manuring because the flood-water that passes over it not only washes over the land but often carries the surface-soil away bodily and in it the fertilizing matters.

56. *No.* 9.—This crop was raised from seed received from Madagascar. The habit of the plant is quite different to any paddy crops raised on the Farm previously. It is especially remarkable for its broad leaves which gives the plants a bushy appearance. The low outturn is chiefly due to the low vitality of the seed ; the plants appeared very unevenly above the ground and the crop was very patchy: they however grew very well and attained a great height; and as they stood far apart they tillered profusely. It was first thought that the Carolina paddy was of this variety ; however the seed differs much from that of the Carolina paddy being narrow and not possessing the golden color which is a peculiarity of that paddy. This variety of paddy owing to its bushy habit might be a good fodder-producer for live-stock but the cost of raising it is very great on account of the long time required to mature it.

57. *Ragi* (*Eleusine corocana*)—*No.* 10.—This crop was raised in a field situated at the northern end of the Farm. The crop varied very much in different parts of the plot ; it grew very well in those places whose surface had never been disturbed but was poor in those that had been stripped of their surface soil. It was sown on the 19th October 1878 and was watered about once in 16 days during its growth. As the harvest-time extended over several weeks most probably a considerable amount of the produce was stolen.

58. *Country Maize—No.* 11.—This crop was raised from seed received from Vellore. The land on which the crop grew is one of the best met with on the Farm, and the maize followed a crop of tobacco, which yielded heavily, and was the first crop after levelling. The deep cultivation under which the tobacco grew was evidently very beneficial for the maize crop. The plants grew to the height of 3 to 5 feet; the cobs were small, but the number obtained considerable; the short time required to attain maturity is noteworthy.

No. 12.—This crop was raised on a different plot of the same field as that on which the maize mentioned above was grown. The land is of good quality but not in so good manurial condition as that mentioned above. The maize was preceded

by a very good crop of cholum (referred to in the next paragraph). The plants grew very vigorously and attained a height of about 5 to 7 feet; the number of cobs obtained were less but the cobs were larger than in the previous case; the 9,200 cobs obtained yielded 112 lb. of dry grain. Although the plants were much higher than in the other case the yield of straw was less; this was most probably due to the plants growing in the first case more in thickness than in height; to the soil that had produced the first crop being much better than that which produced the second; and to the first crop being produced in the cold season, and therefore the plants being probably more succulent.

59. *Yellow Cholum—No.* 13.—This crop preceded the maize crop last mentioned; it was one of the best ever grown during the hot season on the Farm. It was sown on the 5th May; the land, having been manured with box-manure at the rate of 8 tons per acre previously, required very little watering and was only ploughed deeply with a common plough between the lines; the plants grew so vigorously that they suppressed all weeds; the crop was fit for cutting fully a month earlier than it was harvested, but the harvest was delayed on account of unfavorable weather. The outturn is very good: a piece of 100 square yards grown in the centre of the field was cut separately, and yielded 1,672 lb. of green fodder, or at the rate of 80,924 lb. per acre. As is usually the case the yield on the head-lands was much less than in the centre of the field.

No. 14.—This crop was obtained in two cuttings. It is noteworthy that the yield obtained from the second cutting was larger than from the first. The outturn of each cutting separately is satisfactory, and the total 34,997 lbs. per acre is very good. The soil of the plot is of poor quality; it was manured with box-manure at the rate of 8 tons per acre which was applied two days before the seed was sown: the seed was sown on ridges and germinated in a few days. The crop was irrigated five times; the land was ploughed twice with a common plough between the lines. After harvesting the first cutting, the land was again ploughed between the lines but nothing further was necessary to raise the second crop.

No. 15.—This crop grew on the land referred to in paragraph 21 of last year's report. The outturn, 24,800 lb. of green fodder per acre, is very good. The crop attained a height of 12 feet, and is the best crop ever obtained from this field. The good yield is chiefly due to the deep cultivation referred to last year.

No. 16.—The land on which this crop grew belongs to the same field as the plot mentioned above. The yield of this plot was not so high as that of Plot No. 1, the land not having been stirred to so great a depth as Plot No. 1.

No. 17.—The soil on which this crop grew being sandy and poor, the outturn, 11,985 lb. of green fodder per acre, is good. The expenditure in raising this crop was small, only a few waterings having been required and as the land remained clean and the soil friable whilst the crop was grown little was done in hoeing the crop except ploughing with a common plough between the lines.

Nos. 18, 19, 20, 21 *and* 22.—These crops do not call for special comment. No. 18 preceded the Madagascar paddy referred to in paragraph 56. No. 21 followed the yellow cholum referred to; the crop being sown in alternate ridges with castor.

61. *Sugarcane—Nos.* 23 *and* 24.—These crops were produced on two different plots of the same field: a full account of their growth is given in Section III.

62. *Plantains—No.* 24.—This is the crop referred to in paragraph 67 of last year's report. During the year the crop was heavily manured with horse manure at the rate of 10 tons per acre; this is the third time that manure has been applied. The outturn during the year was as follows; it is small:—

—	Number of Bunches.	Weight.	Receipts.
1878.		LB.	RS. A. P.
April	98	1,384	22 14 0
May	26	262	4 12 0
June	2	20	7 7 0
July	4	36	8 1 0
August	5	55	...
September	6	60	5 15 9
October	3	33	1 11 0
November	8	88	1 6 6
December	23	267	0 14 6
1879.			
January	27	220	3 11 6
February	39	358	15 3 5
March	121	1,060	11 11 4
Total ...	362	3,843	83 12 0
Total per Acre ...	215	2,287	49 13 7

Owing to the exceptionally dry weather the cost of irrigation was very heavy, 1 bullock with a driver and a boy for guiding the water being solely employed to supply the water needed during the dry season. The expenditure during the year was as follows :—

Year.	—	Total.	Per Acre.
		RS. A. P.	RS. A. P.
1878	Planting blanks	0 9 0	0 5 0
	Manure and manuring	15 4 0	8 6 10
	Digging and hoeing	21 3 0	11 11 3
	Watering	50 12 0	28 0 7
	Cutting weeds	2 6 0	1 5 0
	Clearing dead leaves	1 2 0	0 9 11
	Cutting out suckers	2 14 0	1 9 5
	Ploughing between rows	6 12 0	0 6 8
	Total ...	94 14 0	52 6 8
	Value of 362 bunches and sundries received in 1878	96 13 0	53 7 10

63. *Sweet Potatoes, No.* 25.—The land on which this crop grew had been recently levelled, the soil is very varied, being a loamy sand at its eastern side but stiffish at the west end, the latter part having been stripped of its surface soil was not properly fit for cropping at the time when the crop was put down ; the southern part was manured with indigo refuse at the rate of 6 tons per acre and with village ashes at the rate of 12 cart loads per acre ; it grew very well where the soil was sandy but always appeared stunted on the stiffer soil. The outturn recorded in the statement was obtained from the sandy portion of the field ; and, considering the poverty of the soil, is not bad. The tubers grown on the stiff soil were not gathered as they were all more or less rotten. The tops of the sweet potatoes were used as cattle food when green ; the cattle seemed to be very fond of them ; their weight was not ascertained, but may be estimated to be about 6,000 lb. per acre.

64. Brinjals (*Solanum melongena*) and Chillies (*Capsicum annuum*), *Nos.* 27, 28 *and* 29.—These crops preceded the Tennay and dholl referred to in paragraph 46. The land was prepared for their reception at the commencement of February ; the plants having been raised in a seed-bed near by. The plants were dibbled in on ridges made 24 inches apart ; on both sides of the ridge. The crops were irrigated generally about once in 6 days and commenced to bear about 16 weeks after being planted. The brinjals continued to produce during about 12 weeks, the chillies

during 8 weeks. The outturn of brinjals is large, No. 27 especially so. In the latter case a yield of nearly 3 tons of fruit per acre were produced in about 7 months; the value of this crop was Rupees 66 per acre.

65. *Tobacco—No.* 30.—The following is an account of the experiment referred to in paragraph 78 of the last report of this Farm. The land selected measured three-fourths of an acre; it had been levelled only a few months previously, and laid down at a slope of 1 in 250; in doing this about 1½ feet of the surface-soil was stripped off in some places and raised in others by nearly 2 feet. Excepting this drawback, the field was very well adapted for the purpose, being in close proximity to a well from which it could be easily irrigated and on account of its physical condition, the soil being a friable sandy loam, but it was in very poor condition especially in the parts that had been stripped.

Land selected.

66. The land was ploughed and subsoiled on the 28th May, and was ploughed a second time and harrowed on the 9th June 1877; it was then manured with horse manure at the rate of 12 tons per acre and again ploughed on the 31st July. After a fourth ploughing at the commencement of February 1878, the land was harrowed and ridged in drills 2½ feet apart. The field being narrow, cross ridging could not be done with the plough and the hills were formed by hand-labor 2 feet apart.

Preparation of the land.

67. The nursery for raising the seedlings was made at the southern end of the field at a place which had been previously filled and therefore did not require much preparation. The ground was dug over to a depth of 1½ feet during the month of Novembr and a second time at the commencement of December; horse manure was applied at the rate of a country cart-load per 100 square feet; and a drain was dug round the nursery in order to provide adequate drainage. The whole was covered with a roof of palmyrah leaves supported on poles.

Management of the nursery.

68. Some Lanka tobacco-seed was received from the Kistna District and a sample of seed was also received from Madura. Professor I. Giglioli, M.R.A.C., of the Royal High School of Agriculture at Portici, had the kindness to send, amongst other seeds, several varieties of tobacco-seed. Three nursery beds were sown on the 3rd of January as follows:—

Varieties sown.

1 bed with Paravaram	Lanka	seed.
1 bed with Gopalapuram	do.	do.
1 bed with Madura	do.	do.

And some days later duplicate beds. Each division measured 8 feet in length and 3 feet in breadth. The seeds obtained from Italy were sown in another nursery in the Botanical Garden close by at the same time. The soil having been reduced to a fine tilth, the seed was sown broadcast and covered with some fine compost manure.

The seed germinated very well and the plants of the first sown seed appeared above ground on the 12th of January, 9 days after sowing. As the plants stood thickly they were thinned out about 14 days after their appearance above ground; they were watered frequently during the first and the second week but received less water afterwards. The plants grew luxuriantly and had put out 4 to 6 leaves and were ready for transplanting by the middle of February.

Treatment in the nursery.

69. The soil being very poor in organic matter, to improve its physical qualities, before planting two handfuls of well rotted manure were put in each *hill* and mixed with the top soil. The transplanting of the seedlings commenced on the 13th of February and continued for some weeks, only one man being employed for about 1 hour after 5 P.M. The field was divided into 3 equal plots. Two plots were planted with seedlings raised from Lanka seed and the other plot with plants raised from the Madura and Italian varieties, the last-named plants, however, occupied only a few rows. The plants after being

Method of planting out.

planted were watered at once and shaded with palmyrah leaves during the first few days; they were watered daily for about four days and afterwards at greater intervals. Although it was very hot at the time, nearly all the plants took root, the few that died being replaced from the nursery.

After cultivation and treatment.

70. The land was hoed twice, the soil being heaped up around the plants each time. Saltpetre was applied when the plants were about one foot high. The saltpetre was applied in a dissolved state at the rate of one cubic inch per plant, or about 200 lb. per acre. The flower-buds appeared about two months after planting and were broken off at once; and with them the bottom and some of the top leaves, only 7–8 being left at first but, on finding that more leaves could be left without detriment to the plants, 10–14 were left afterwards. (Subsequently in the Botanical Garden some small plots of tobacco of the same varieties were raised, when as many as 24 leaves were left, which all grew to a large size.) At the time of topping several varieties of grass-hoppers attacked the tobacco leaves; and some persons were employed for several hours every morning to kill them. The suckers, which appeared in the axils of the leaves, after topping the plants were broken off once in every four or five days. Water was applied once in every 4–8 days according to the state of the weather.

71. Of the plants raised from the seed received from Italy, only a variety of the *Macrophylla* species succeeded; it grew luxuriantly to a very great height, and the leaves were very large, thin, and appeared to be of fine quality. The plants raised from Madura seed belong apparently to the Virginian species (*Nicotiana augustifolia*); the leaves are very long, some as much as $2\frac{3}{4}$ feet, but much pointed. The Lanka tobacco produced very large leaves, which warped very much and became very gummy, thick, and coarse.

72. In spite of their being planted $2\frac{1}{2}$ feet apart, the plants spread so much that there was no room to walk between the lines, especially in those parts of the field that had been filled when the field was levelled. The consequence was that many leaves were torn and rendered valueless. During the latter part of the growth several showers of rain, followed immediately by sunshine, caused rusty spots on the leaves.

Ripening and harvest.

73. About three months after transplanting the plants began to ripen, and the harvest was commenced at the end of May. After cutting, the plants were immediately placed under the shade of a large mango tree standing close by. Bamboos had been previously cut in lengths of $4\frac{1}{2}$ feet and on each bamboo eight of the large or twelve of the small plants were hung. A framework had also been erected, on which the bamboos with the plants were so placed as not to allow the latter to touch the ground. After the plants had hung in this manner for a day they were sufficiently wiltered to be removed to the drying-shed.

Management of leaves in the drying-shed.

74. This shed was furnished with bamboo frames in two tiers; the first 4 feet and the second 8 feet above ground. The tobacco on being brought to the shed was hung close together on the lower tier, and, after six or eight days, having gone through a slow fermentation and turned to a light yellow color, was hung on the upper tier further apart to arrest rapid and injurious fermentation. The shutters, which were kept closed during the first week, were opened afterwards unless the wind was very dry. After the second week the plants were again hung more closely; those that were placed originally on two or three being hung on one bamboo. They remained thus until stripped, being examined occasionally in the interval. They were fit for stripping, that is, the midribs were thoroughly dried, about twenty days after the tobacco had been brought to the shed. The air being at that time exceedingly dry the leaves could not be stripped at once on account of their brittleness; it was necessary to wait for a shower of rain to moisten the air; one fell soon afterwards, and the leaves became sufficiently soft and pliant to be easily handled.

Stripping.

Experiment in bulking.

75. An experiment was made to bulk part of the tobacco ten days after it had been brought to the shed. For this purpose a floor was made of some planks covered with straw and on this the tobacco was laid, tied in bundles of ten plants each; between the layers some straw was put. The heaps were about 5 feet square and $3\frac{1}{2}$ feet high. The first day the temperature in the centre of the heap reached 95° and the leaves appeared improved, but on the second day it had risen to 105°, and the heap was rebulked; it however heated again rapidly, and the next day it was found that the tobacco had sweated very much, and, on opening some bundles, it was discovered that some stems had commenced to rot. The tobacco was then again hung on the frames and kept there for some days and afterwards was bulked again, but after about eighteen hours, when the heap was reopened, it was seen that the thick stems had again commenced to rot, this time also affecting part of the leaves. Some other tobacco, which was not kept so long in bulk at one time, did not rot as much, but in this case also the results were not satisfactory, most of the leaves turning dark-brown and losing more or less of their elasticity.

Further experiments.

76. Some other tobacco was put into a heap in the evening of the second day after cutting; the whole, about 100 plants, occupied only three courses; it was lightly covered with straw and some planks. When examined the next day, it was found that the tobacco had sweated much, and the temperature had risen to 115°. Some of the leaves, especially those in the centre, had turned brown. This tobacco was evidently bulked in too green a state, and could not withstand the great heat.

The same evening some other tobacco, about 200 plants, that had been cut four days previously and contained less sap was put into a heap; the plants being left, in this case, on the bamboos. The heap was about twice as large as in the foregoing experiment, but less compact, the bamboos causing many empty spaces which facilitated the circulation of air in the heap. This heap was examined, with the heap mentioned before, the next morning, and it had only commenced to sweat and the temperature had risen to 110°; and the leaves had attained a light yellow color. The tobacco of both heaps was rehung and treated like the rest, there being insufficient room to carry out separate experiments.

It is probable that by bulking tobacco in small heaps for a short time in such a way that the moisture can escape and so prevent strong sweating, as done in the last experiment, the color of the tobacco may be fixed in a short time and some days may be gained in drying the leaves; most probably tobacco would attain a more uniform color when treated in this way than otherwise.

Outturn.

77. At the end of June the leaves, having absorbed some moisture from the air and become pliant, were stripped. At the commencement of July the air contained so much moisture that the tobacco commenced to turn mouldy; it was then exposed to the sun for a few days and the mould brushed off. When stripping four classes of leaf were made, but it was difficult to make the men who stripped understand how to classify properly. The whole outturn was over 1,000 lb. of dry leaf, not including the suckers and bottom leaves removed from the plants on the field. The percentage of first-class leaves was small on account of the tearing of many leaves in the field by the coolies who had no experience, and on account of the bulking experiments which yielded only third-class leaves. The tobacco after stripping was put into a heap, where it heated slightly and was rebulked after ten days and again one month later, after which time heating was scarcely perceptible.

General results.

In this experiment the Lanka tobacco was found to produce heavily, but the leaves were thick and coarse. The Madura tobacco yielded heavily and also produced a fine leaf. The most successful however was the Maryland (*Macrophylla*) tobacco, which yielded the largest return and the finest leaf.

78. Some seed of the above-mentioned varieties, as also of the Kentucky variety, was sown on the 1st of May 1878 for a further experiment. The nursery bed was made in the same place in which the plants for the previous experiment

had been raised. The seeds germinated well, and the plants were planted out on the 20th of June; they were treated in the nursery bed and after transplanting just as in the previous experiment; they grew very well, but it was observed that those of the Lanka variety did not grow so high as in the former experiment and that the leaves also were not so large. The plants of the three other varieties attained a height of from 5 to 8 feet and developed from six to twenty-four large sized leaves. The tobacco was cut at the commencement of October and was cured in the same manner as described above with very good results; the leaves assumed a golden color, this was gained by simply hanging the plants on sticks closely so as to prevent rapid drying.

Another experiment.

79. *No.* 29.—Several varieties of tobacco seed having been received from America another experiment in tobacco cultivation was instituted to ascertain the comparative value of each. The seed was sown on the 12th October 1878 in the place where the plants for the former experiments had been raised. The following were the varieties of seed sown :—

Maryland ; raised on the Farm.
Kentucky ; do. do.
Madura ; do. do.
Do. ; received from Madura.
Trichinopoly ; do. Trichinopoly.
Virginian ; do. America.
White-stem ; do. do.
Havanna ; do. do.
Lanka ; raised on the Farm.

Growth and treatment in the nursery.

The plants appeared above ground about eight days after sowing the seed, and were planted in open beds on the 10th November 1878. Although the sun was very powerful at that time nearly all the plants took root, water being applied twice daily for a few days after transplanting. They remained in the second nursery bed until the middle of December, when they were planted in the field. Part of the same plot used for the experiment of 1878 being again used; the land being prepared in the same way as previously. The seedlings were planted in holes made on hills, about 5 square feet being allotted to each plant; and cloudy weather having been utilized for planting very few of them died. The plants raised from Farm seed, except those of the Lanka variety, took root easily and grew rapidly, as well as the plants raised from seed received from Trichinopoly ; but those raised from seed received from America never grew properly and the plants attained only a small size; those raised from Lanka seed did not thrive well and the height attained was only about 2 feet. All the varieties were similarly treated as to preparation of soil, manuring, watering, &c. The plants were watered by means of watering pots for the first few days after transplanting, and received only four waterings afterwards, the heavy dews occurring during the whole time of their growth rendering more frequent irrigation unnecessary ; and it is possible that watering might have been entirely dispensed with without impeding the vigorous growth of the plants. The land was only hoed once, most of the plants growing so vigorously and spreading so much that it was difficult to walk through the lines without breaking the leaves; a second hoeing was also unnecessary because only a few waterings were applied so that the soil remained friable, and the early spreading of the leaves checked the growth of weeds.

Acclimatized seed succeeded best.

After-treatment of land and crop.

80. The three varieties mentioned first grew on land that was used for the first tobacco experiment, and the plants of these varieties were the most vigorous and healthy of all ; this is undoubtedly partly the result of the plants having been raised from seed grown on the Farm; but this cannot be the sole cause, and it is well known that, when tobacco is consecutively grown on the same field, the crop grown in the second year often yields more heavily. This is easily explicable ; for the first crop the soil, if not extraordinarily rich, is generally heavily manured, so that, if a special manure has been applied to supply the potash and lime needed,

the soil, after its growth must be in a better manurial condition than before: if the land be again heavily manured for the second crop that crop should have more chance of succeeding than the first; the mechanical treatment of the soil before and during the growth of the first year's crop must considerably improve the physical properties of the soil and has undoubtedly an important effect in this respect.

81. Saltpetre was applied at the rate of 200 lb. per acre; it was applied in a dissolved state and directly to the plants. By mistake common salt at the same rate was applied to the two first varieties instead of saltpetre. This may have caused the plants to grow more vigorously than those in some of the other plots, it being well known that tobacco manured with common salt generally yields heavily, but produces a coarse leaf. About two months after planting, the flower-buds appeared, and were broken off with some of the upper leaves, from twelve to twenty leaves being left according to the size of the plants. The plants of the first, second and third experimental plots arrived at maturity about the end of February when they were harvested. The Virginia, the White-stem, the Havanna, and the tobacco raised from Trichinopoly seed required apparently fully a month more to attain maturity, but were cut down when the tobacco in the first experimental plots was harvested on account of an insect attack.

Ill-effects of common salt as a manure.

82. The tobacco grown in the first four experimental plots was cured in the same way as in the previous year. During this experiment the plants however required about a month's drying before being fit for stripping, because the tobacco was harvested at a time when there was more moisture in the atmosphere than during the first curing experiment. The stripping was only commenced at the end of March and the outturn of leaves cannot be ascertained at present. It is believed that some plots yielded at the rate of 1,800 lb. per acre. The tobacco of the remaining experimental plots was cured according to the mode often adopted by ryots in this country:—The leaves were stripped in the field and put into heaps; two days after the heap was rebulked and again left for two days, after which time it was opened and was found to be much heated, some of the leaves had become brown, others only yellow, and others still remaining green; the tobacco was then hung up on a scaffold and dried to arrest decomposition. The tobacco remained on the scaffold for two days, after which time it was again put into heaps; when it had become heated it was again rebulked; this process was continued for about a week more, after which time most of the tobacco had dried and assumed a brown color and emitted a rather sharp pungent smell, which was considered by some Natives to be a sign of good tobacco. Curing according to this fashion involves much labor, but though the tobacco obtained may find a market in the Native bazaar for ordinary consumption, it would certainly not be appreciated by Europeans. Another drawback resulting from this mode of curing is that the tobacco must be worked over so often that it is nearly impossible to get an unfractured and smooth leaf well adapted for cigar manufacture.

Curing of the crop.

83. The last experiments in tobacco cultivation tend to corroborate the conclusions drawn from the results of the first experiment, that under proper cultivation the soil and the climate met with here admit not only of raising a fine tobacco but also a tobacco that yields heavily. The results of the last experiment also show that when tobacco is grown during the cold season irrigation may be entirely dispensed with, thereby not only reducing the cost of cultivation but enhancing the outturn, because the soil remains more open and friable and produces a finer tobacco than when the soil has assumed a close texture from frequent irrigation.

Conclusions drawn.

84. The *Macrophylla* species has now been raised three times on this Farm during the past year at different seasons, and has always succeeded, showing thereby that it is well adapted for the conditions met with, and as it yields a good tobacco and produces heavily it should be extensively cultivated. The same must be said of Kentucky tobacco, which has now been grown twice, once during the cold and once during the

Varieties which have succeeded.

hot season. Next to these two varieties comes the tobacco raised from Madura seed. As regards the suitability of the Havanna, White-stem, and Virginian varieties, the non-success of the first attempt cannot decide the question; some more experiments will be necessary. The Trichinopoly tobacco (a Virginian variety) succeeded tolerably well, but as the leaves are very narrow and therefore not well adapted for covering leaves for cigars, this variety does not deserve much attention.

Raising seed.

85. Tobacco seed has been raised of all the varieties above referred to. The seed was ripe about two weeks after the leaf had matured. The plants that were allowed to run to seed were cut down immediately above the surface when most of the seed capsules had assumed a brown color; they were then tied in bundles of 8–10 plants each and hung up in a room head downwards; by this means the seed that was not fully matured ripened completely. After two or three weeks, when the stems of the plants had become completely dry the seed was threshed out and dried; seven large plants of the Kentucky variety yielded 14 ounces of tobacco seed, which would be sufficient to raise plants for 14 acres. The *Macrophylla* and Madura varieties raised on this Farm will yield an equal amount of seed, but the plants of the other varieties much less as the plants are much smaller and produce only a small sized panicle.

Second growth of leaves.

86. Soon after the plants had been cut down, new shoots issued from the remaining stalks, which grew very vigorously and attained a height varying from 2 to 3 feet in the first plots; the new shoots of the *Macrophylla* tobacco are the most vigorous; generally two shoots have been left, the number of leaves on the plants are between twenty and forty, but they are much smaller than those of the first growth. After cutting the first crop the land was once ploughed between the lines and received one watering. No further hoeing or watering will be required to mature the second crop.

87. During the year the total extent of cultivable land was 145·94 acres. The following areas of crop were raised:—

	ACRES.
First crop harvested before April 1st	102·13
Do. standing on do.	24·87
Second crop standing on do.	43·48
Do. harvested before do.	44·06

So that a total area of 214·54 acres of crop were raised; of these, some were grazed down by live stock and it has not been possible to record the outturns. The number of pairs of cattle maintained to perform the cultivation of the land referred to was 15½ pairs, but they were employed on this work only during part of their time, as they also performed a considerable amount of work for the estate.

SECTION III.

MANURES.

88. *Manuring Experiments.*—The great alterations made with nearly all the fields on the Farm during the last few years prevent in some measure the satisfactory making of manuring experiments; the results of the experiments of the past year show clearly that our soils are as yet scarcely sufficiently uniform for the purpose.

89. *Top-dressing Sugar-cane.*—The soil of the field in which the experiments, the results of which are recorded below, were made, is of a stiff and adhesive character, its nature not being due to the presence of clay but to its physical state.

Preparation of the land.

The land was prepared for planting by scarifying and harrowing it twice, and ploughing and subsoiling it to the depth of about 1 foot; it was then rolled and trenches were made with the plough about 4 feet apart, which were deepened subsequently by hand labor. The whole field was manured with blood-manure before planting at the rate of 12 tons per acre. Two varieties of sugar-cane were planted, a white variety and a red variety; the shoots of both were obtained from Bangalore. The sets were placed in the trenches about 1 foot apart and were covered with a little soil; this was done at the end of January 1878 and the field was constantly watered for some days after. When the shoots were about $1\frac{1}{2}$ feet high saltpetre was applied, to plots each $\frac{1}{30}$th acre in area, at the rates mentioned in the following table:—

	Top-dressing applied per Acre.		Outturn.				
	Quantity.	Description.	Number of Canes.	Weight of Canes.	Weight of Straw.	Total Weight.	Total per Acre.
	LB.		LB.	LB.	LB.	LB.	LB.
White Cane.	$112\frac{1}{2}$	Saltpetre ...	146	188	2	190	5,700
	225	Do.	172·5	402·5	94	496·5	14,895
	$337\frac{1}{2}$	Do.	380	856	224	1,080	32,400
	450	Do.	215	463	94	557	16,710
	...	None	381·5	781	192	973	29,190
Red Cane.	$337\frac{1}{2}$	Saltpetre ...	71	78·5	120	198·5	5,955
	450	Do.	265	315	364	679	20,320
	...	None	225	224	250·5	474·5	14,235
	$112\frac{1}{2}$	Saltpetre ...	125	119	224	343	10,290
	225	Do.	225	244·5	224	488·5	14,655

After-treatment of the crop.

90. During the growth of the crop it was hoed five times and was watered whenever necessary; as this water had to be raised a considerable height by bullock labor, the expenses under the heading were very great. At the end of July, 15 tons of horse manure per acre were applied to the crop with a view to accelerating its growth. Owing to the attacks of white-ants from the very commencement the crop was very patchy, and about the middle of December, some time before the canes had fully matured, it was so severely attacked by rust as to necessitate its being cut down, so that the results obtained must be received with caution; neither the soil nor the other conditions of growth being favorable. The results given are the averages of two plots of white and red cane respectively, the results which stand first on the table being those obtained with the white cane. As the great variations show, the value of these results is small; they appear, however, to show that saltpetre is of doubtful value for this crop on such land.

91. *Manuring Cotton.*—A series of experiments were commenced during the year with a view to duplicate the results obtained in 1872 with the crop. The same value of top-dressings was applied, but owing to the failure of the maize crop, they were unable to exert their full effect. At the same time an attempt was made to determine the most economical amount of box manure to apply to the land. The field on which this crop was produced was levelled early in 1878; the land was stripped of its surface in some places to more than 1 foot in depth and in other places the surface was raised more than half a yard to give the field a suitable slope for irrigation and drainage purposes; it was then allowed to lie fallow, and was deeply cultivated several times to hasten amelioration of the soil. The soil is a sandy loam, open and friable. When the land was ready about the end of August it was ridged up by means of the ordinary iron plough in ridges about 20 inches apart; the box manure was then carted on and spread between the ridges, which were split over the manure to cover it. Before covering up the box manure, the substances mentioned below were applied to duplicate plots, each measuring $\frac{1}{10}$th acre, at the rates mentioned; the value of the special manure in each case was

Preparation of the land.

Manures applied.

Rupees 18 per acre. After the manure had been covered, the ridges were sown alternately with maize and cotton. The following are the manures used and the amounts applied:—

—	Plots 3 and 12.	Plots 1 and 10.	Plots 2 and 11.	Plots 4 and 13.	Plots 5 and 14.	Plots 6 and 15.	Plots 7 and 16.	Plots 8 and 17.
	TONS.	TONS.	TONS.	TONS.	TONS.	TONS.	TONS.	TONS.
Box manure	4	8	12	8	8	8	8	8
Saltpetre	...	...	...	440 lb.	...	...	...	...
Bone charcoal ...	...	...	...	...	1,080 lb.	...	...	...
Slaked lime	...	...	...	...	...	4,800 lb.	...	...
Castor-oil cake ...	...	...	...	...	...	...	1,665 lb.	...
Gypsum	...	...	...	...	...	...	...	3,150 lb.

91. The cotton seed germinated very well, and the plants appeared evenly over the whole field. They grew very vigorously and the whole crop is, as regards uniformity and vigor of growth, one of the best ever produced on the Farm. The land is also remarkably clean and free from weeds. The plants only commenced to bear at the end of January; the lint of the first gatherings was of very fine quality. The outturn up to the end of March was very good. The results of the crop and of the experiments will be given fully next year.

SECTION IV.

LIVE-STOCK.

92. *Stock-breeding Experiment.*—The Commissariat slaughter-houses, the cause of great nuisance to the Farm complained of every year, have not been removed as yet, and consequently the stock-breeding experiment has again been delayed. It is however hoped that these yards will at length be removed during the early part of the present year. A great amount of trespass is due to their presence on the Farm. On killing days the slaughter-yards are visited by a great number of people from Saidapet and other villages for the purpose of purchasing and removing offal. Many of these do not leave the yards till after dark, which makes it impossible to check entirely the trespass. The pilfering of our crops is chiefly due to the great crowd of people passing through the Farm on their way to or from the slaughter-houses. The sheep, when being driven to the yards to be killed, destroy many fine trees planted on the sides of the road. The number of people visiting the slaughter-house was—

Large amount of trespass due to the presence of slaughter-yards.

On killing days about	129
On other days about	38

93. *Australian Cows.*—To make a start in breeding cattle for dairy purposes, in December 1878 two cows were purchased which had been brought from Australia. The cows had calved shortly before they were shipped, and were about 6 years old. It was stated that they yielded daily about 9 measures of milk each when on the voyage. One of the cows resembled to a certain extent the animals of the Short-horn breed, and the other slightly those of the Devon breed. Both cows were of large size but in rather low condition when purchased; otherwise they looked quite healthy. Rupees 200 was paid for each cow, not a high price considering their age and good milk-producing capabilities. At first the cows would not take any food except bran, but they were gradually accustomed to oil-cake and green fodder. Their ration of food was at first of 3 lb. of bran. After

Description.

Food given.

some days 1 lb. of oil-cake was mixed with the bran. The ration was gradually increased to 6 lb. of bran and 3 lb. of oil-cake per day. They were fed twice daily; in the morning at 6-30 and in the evening at 4-30; at which times they were also milked. They received about 50 lb. of green fodder per head a day; they were also allowed to graze every morning from 8 until 9. They only yielded a little milk for the first few days, but more, in proportion, as their appetite improved. Both the cows greatly increased in weight after they became accustomed to the food, and were very fine-looking animals and full of vigor at the commencement of February.

94. However, both died suddenly on the 7th February last. They exhibited no symptoms of sickness until the 6th evening, when one of the cows, called Shorthorn, gave no milk and refused her food; her eyes appeared watery and she had some light purging. The next morning this cow voided blood, bad saliva passing from her mouth, her horns were cold and her coat appeared rough. The symptoms of sickness became worse as the day advanced and the cow died at 3 P.M.

Sudden illness.

The second cow, called Devon, appeared quite well up to the 7th morning, at which time however she did not give a full yield of milk. She seemed quite well at 10 A.M.; at 11 A.M. however she had an attack of convulsive fits which increased rapidly in severity and the cow expired at 2 P.M., immediately after Veterinary Surgeon Western had left.

95. The following is a copy of the report of Veterinary Surgeon Western regarding the sickness and death of the two cows:—

"I have the honor, in compliance with your request, to inform you that as a result of my investigation into the matter of the death of the two Australian cows on the 7th February 1879, I am of opinion that the cause thereof was the disease called "Anthrax," in that particular form commonly known in England as "Splenic feres." The fact of these two only of the Farm cattle being so simultaneously attacked induced a belief that something injurious in their food, or possibly intentional poisoning might have been the origin of their illness; but the *post-mortem* appearances entirely set aside such suspicion. The black, tarry fluid condition of the blood, the enlargement of the spleen, the bloody fluid in the abdominal and thoracic cavities with the extravasations of blood about the roots of the large blood-vessels and beneath the lining membrane of the ventricles of the heart and other changes found alike in both carcasses, were peculiarly characteristic of anthracoid disease. More animals die in this country from maladies of this class than of any other disease, rinderpest perhaps alone excepted. It is supposed to be of miasmatic origin, and organic matters undergoing decomposition under the influences of humidity and a high temperature, are said to furnish the germs which give rise to it. These, if recent researches into the nature of the disease are to be relied on, would seem to be organisms called bacteria, which, acting as a ferneous in the blood, bring about in it such changes as render it unfit for the nutrition of the tissues; and, by arresting the function of the more important organs, rapidly produce disorganisation of the whole system and consequent death of the animal. Damaged forage, as that which is mouldy or affected with fungi, or water of a brackish, marshy or putrid character and charged with organic matter, have been blamed as aiding in the production of anthrax; while a condition of the animal, consisting in the loading of the system with waste organic matters, is said to be brought about by overfeeding and plethora in such as make flesh most rapidly, in the young and rapidly-growing, but especially in those quickly recovering condition after previous emaciation, which is thought to predispose to the reception of the poison and development of the disease. It is found to be most prevalent in marshy districts where water stagnates, or on the banks of rivers where pastures are liable to be submerged, and the injurious effects of these conditions are increased when the soil contains sulphates or other saline matters which favor the decomposition of organic substances. Principal Veterinary Surgeon F. F. Collins speaking with regard to equine anthrax (Loodiana disease) writes in a recent number of the Veterinary Journal: "I have found by the annual reports received from Veterinary Surgeons that the nature of the soil at all stations where malignant fever shows itself is identical, *viz.*, alluvial with a clayey subsoil;" lastly anthrax is propagated by contagion. The isolated condition of the two cows on the Farm almost precludes the possibility of their having been in contact with diseased cattle unless through the medium of manure brought from the slaughter-house; their food the same as that used for all the other cattle on the Farm was cake bran and green cholum; this latter was rusty, *i.e.*, affected with fungi, and although these cows only were sufferers, that fact does not render it impossible that this case may have had something to do with their illness, because it is well known that animals will often thrive on food to which they are accustomed, although on others not habituated to its use it may act as virulent poison. The shed in which they were kept is

on low ground near the banks of the river an alluvial sand; it has, I am told, for years been used as a cow-shed, and the soil underlying those occupied by all the Farm cattle is the same alluvial bed. The river is at present low and much of the usually submerged soil is now exposed to the drying effects of the sun. The river-flats have recently been undergoing "puddling" for paddy, and the flood-water was lying in all the hollows near. The water is charged with sulphuretted hydrogen and all kinds of bad-smelling organic matter. The cows very probably drank some of this water and may have eaten of the grass growing on the river banks, and although I learn that sheep now graze on the banks with impunity, experience has proved that at certain seasons fatal disease occurs amongst those permitted to do so, and it is well known that animals may become inured by residence in a malarious district and less apt to suffer from its injurious effects than new-comers. The cows were not only new-comers, but had recently undergone the ordeal of a confinement on boardship, calculated of all other conditions to bring about the condition of system I have referred to as predisposing to the disease, a condition likely to have been aggravated by exposure to a hot sun and close muggy weather to which they were unaccustomed. Their food on the voyage was probably only bran and chaff, and the change though their food at the Farm could not be considered high living, was at any rate to food more nutritious than they had recently received. Although then I am unable to point to the precise cause in operation for the production of the disease in these cows, and although, as I have shown, the other cattle of the Farm were subjected to similar conditions, it must, I think, be admitted that some at least of the ordinary conditions known to favor the development of anthracoid disease were in existence. This unfortunate termination of an experiment to acclimatize imported cattle need not, I think, discourage future attempts in the same direction, inasmuch as the conditions above referred to as probably causing the disease may in great measure be avoided. Referring to the suspicion of poisoning, I would suggest that a few experiments on the action of vegetable poison which are alleged to be in common use for the criminal destruction of animals might with advantage be made with a view to the recognition of the symptoms and *post-mortem* appearances by which such poisoning may be recognised. A small sum would suffice for the purchase of a few otherwise worthless animals as subjects for such experiments, and the information to be gained would, I think, be valuable in assisting in the suppression of such crime if it really be practised. I am however inclined to the opinion that statements as to the use of vegetable poisons have been published on very loose and unsatisfactory evidence."

96. Suspicions having been entertained at that time that the death of the cows was caused by poison, the stomach with its contents was forwarded to Mr. W. Hamilton, Assistant Professor at the Medical College and Lecturer in the Agricultural College, with a request to analyse the contents of the stomach with the view to ascertain whether it contained any poison. The following is a copy of the letter received from Mr. Hamilton regarding the matter:—

"With reference to your letter of the 8th instant, No. 431, I have the honor to inform you that I received the viscera and contents sent therewith. The absence of mineral poison having been proved, an alcoholic extract, prepared from the contents of the stomach and small intestines, was eaten by a small dog without any injurious consequences following."

97. The following table shows the yield of the milk of the two cows from the date of their arrival on the Farm until the date of their death:—

Month.	Quantity of Milk.	Value.
	MRS. OLKS.	RS. A. P.
December 1878 ...	283 $3\frac{1}{4}$	47 3 9
January 1879 ...	314 5	52 7 0
February „ ...	58 5	9 12 4
Total ...	656 $5\frac{1}{4}$	109 7 1

98. The cost of feeding the cows during the time was as below:—

	RS. A. P.
146 lb. ground-nut cake	2 14 9
916 lb. bran	18 5 1
6,800 lb. green food	22 10 8
Cost of attendance and sundries	9 0 0
Total ...	52 14 6

The figures show a net income of Rs. 56-8-7 during the ten weeks that the cows lived. The result shows how very valuable a property good dairy cows are, and were it not for the greater risk attending the breeding of English cows than those of indigenous breeds, the shortest way to the improvement of Indian dairy stock would be to import cows from Australia. Under any circumstances it will be advisable to import some bulls of good breeds for crossing on the native stock.

Value of good dairy cows.

99. *Aden Cow.*—This cow, referred to in paragraph 99 of the last year's report, continues to give most satisfactory results. She calved in June last, or about a month before she was due, and consequently the cow was in bad health for some time after. The calf also was very delicate for some time; it was a heifer, all the previous ones having been bulls; this is fortunate, as it will be available for carrying on the breed, especially as the cow shows signs of approaching old age. The cow is expected to calve again in July next.

The following table shows the yield of milk from this cow from the middle of July 1878 until 31st March 1879; up to the middle of July all the milk was given to the calf.

—	Yield of Milk.	Value.
	MRS. OLKS.	RS. A. P.
July (15 days)	24 0	4 0 0
August	55 6	9 4 8
September	75 0	12 8 0
October	77 4	12 14 8
November	75 4	12 9 4
December	76 3	12 11 8
January	81 5	13 9 8
February	71 2½	11 14 2
March	73 1	12 3 0
Total ...	610 1½	101 11 2

The cost of producing this milk was as follows:—

	RS.	A.	P.
500 lb. of ground-nut cake	10	0	0
560 lb. of bran	11	3	2
8,520 lb. of green food	28	6	5
Cost of attendance and sundries	9	8	0
Total ...	59	1	7

So that in this case the milk cost 1 anna 7 pies per measure. The cow, it will be seen, gave a net profit during the milking time of Rupees 42-9-7 besides bringing up her calf.

100. *Nellore Cow.*—A cow of the Nellore breed was also purchased during the year. This cow was bought chiefly with the view of using it in carts, so as to demonstrate the value of cows as draught animals. She was easily trained in a single cart and was generally used in light work, such as carting green fodder from the field, &c. She was used until about two weeks before she calved. The calf—a heifer—was well developed when born and does not appear to have suffered in any way from the work her mother had to perform until close to its birth. The daily yield of milk up to end of the year was about 2½ measures; the cow also rearing her calf. It will be a great boon to this country when the ryots can be induced to look upon their cows as draught animals and to use them as such. In some parts of Germany the small farmers use nothing but cows for the performance of agricultural operations, and even the large landholders frequently use them for light work. Arrangements are generally made that the cows may calve at a time when little or no farm work can be performed, so that the yield of milk after calving, when they have no work to perform, is unaffected,

Worked regularly.

Value of cows for draught purposes.

and when they are put to work every day for half a day some months afterwards the yield decreases only slightly. It is considered generally that cows that are put to light work are more healthy than those kept always in the byre. During forty-six days after calving this cow yielded 114 measures 1½ ollocks of milk, worth Rupees 19-0-6; the cost of maintaining her during the same time having been Rupees 12-2-2; the milk in this case was produced at 1 anna 8 pies per measure.

Cost of milk.

101. *Sheep.*—The improvement of the flock is proceeding steadily but slowly. If animals of a better breed are not used for replacing or crossing the Farm breed of sheep, it will require many years more to bring the wool of the flock to such a degree of perfection that it will command a price more in proportion to the value of the food consumed to produce it than is at present realizable. As the production of a pound of coarse wool requires the consumption of nearly the same amount of food as one of fine, it is very desirable to improve the wool of the flock in the shortest time possible to such an extent as to make it find a ready market and fit to compete with the fine wools of other countries in the European market. At present great difficulty is experienced in finding a market for the wool in this country at a fair price. In order to hasten the improvement of the sheep more rapidly than can be possible under the present arrangements, the advisability of importing some sheep of the Merino breed from Australia should be considered; sheep of that breed generally stand a dry hot climate very well.

A wool saleable in European market required.

The death-rate of the sheep on the Farm was high during the year, it being as much as 13·14 per cent. The following table gives the figures relating to the subject for the past six years :—

—	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.
Average number of flocks	207	221	237	275	295	274
Number of deaths	16	24	21	11	31	34
Percentage of deaths	7·73	10·9	8·9	4	10·5	13·14
Rainfall in inches	48·07	68·98	38·14	20·88	65·55	33·16

Most of the sheep died suddenly, death being caused, it is believed, generally by heat apoplexy; but this year again a number of rams died from injuries received when fighting with one another.

102. The following table is a continuation of that given in the reports of the last two years regarding the wool-production and size of our sheep :—

—	1877.			1878.			1879.		
	Number.	Average Weight.	Yield of Wool.	Number.	Average Weight.	Yield of Wool.	Number.	Average Weight.	Yield of Wool.
Rams.		LB.	LB.		LB.	LB.		LB.	LB.
Lambs	38	28	Not shorn.	28	38·6	Not shorn.	...	...	Not shorn.
Shearlings	31	47	1·76	...	52·6	...	18	47·2	1·55
2 shear	16	66	2·28	...	...	...	25	66·5	1·56
Other ages	23	69·5	1·94	...	73	...	30	81·5	1·66
Average	70	58·74	1·94	80	66·2	1·57	73	67·9	1·60
Ewes.									
Lambs	27	25·6	Not shorn.	31	31	Not shorn.	...	...	Not shorn.
Shearlings	34	39·6	1·6	35	45·6	1·8	26	43·8	1·42
2 shear	23	48	1·77	...	...	...	36	57·3	1·63
Other ages	84	53·17	1·31	101	54·5	1·6	83	61·1	1·63
Average	141	49·05	1·45	136	52·2	1·65	145	57·0	1·59
Average of sheep of all ages.	211	52·27	1·62	216	57·4	1·62	218	60·6	1·59

The figures show that, although there has been a marked increase in the average live weight of the sheep, the yield of wool was slightly less this year; the chief decrease being in the case of the young sheep.

103. *Pigs.*—On the 23rd October, two boars and one sow with four sucklings were purchased. The price paid for them was Rupees 85; a very moderate sum. The pigs are not first-rate, but are of fair size and apparently of quick growth. The young ones, which when purchased were about six weeks old, grew well, and will be fit for breeding purposes when about nine or ten months old. The weight of the pigs on the 9th April was as follows:—

	LB.	
1 old boar	309	about 2½ years old.
1 „ sow	282	
1 large young boar	151	purchased as sucking pigs; age 7 months.
1 small do.	112	
1 large young sow	122	
1 small do.	91	

The following table shows the food consumed by the pigs up to the 31st of March 1879, and its cost:—

	RS.	A.	P.
1,824 lb. of ground-nut cake at Rs. 9 per candy ...	32	13	3
1,014 lb. of bran at 50 lb. per rupee	20	4	6
374 lb. of tour at 71 lb. per rupee	5	4	3
Total ...	58	6	0

The pigs were fed twice daily; in the morning at 7 and in the evening at 5 o'clock; they were confined the whole day in the styes because there is no proper accommodation for pigs at present on the Farm. When the slaughter-houses are transferred to the Farm, proper arrangements can be made for pig-stock; the styes must have free ventilation and be at the same time protected from the sun. A yard for exercise close by, shaded by some trees and supplied with a small tank, &c., should also be provided.

104. *Poultry.*—The Pekin ducks imported from China in July 1875, referred to in paragraph 50 of the annual report for the year ending 31st March 1876, died off during the past year. It will be remembered that for some time after their arrival the ducks got on very well; they appeared to enjoy perfect health and laid a great number of eggs, many of which were sent into the districts for breeding purposes; but after the first hot season their health gave way, they almost ceased to lay eggs, and several of them died. They altogether ceased laying eggs at the commencement of last year, when several of them also died within a few weeks. To prevent the entire loss of the breed arrangements were made with Mr. Bird of Ootacamund to receive two ducks and one drake from the Farm, and to give in exchange a number of ducklings of the same breed as soon as available. The birds throve very well in Ootacamund at first, but died rather suddenly some months afterwards. As the ducks did well at first it is probable that those imported were not young when received and succumbed to the effects of the climate as they grew older. As the breed is a very fine one, the importation of a further supply may be advisable.

Loss of all the original importations of Pekin ducks.

SECTION V.

FOODS AND FEEDING.

105. No feeding experiments were made on the Farm during the year; but, although it cannot be denied that for experiments in this direction there is still a large field not touched on as yet in this country, with the means available, it is not advisable to attempt such investigations. In practice it is often found that the best results are

Experiments required to determine comparative value of foods.

not always obtained from foods considered the best from a chemical point of view; on this account it is necessary to ascertain the feeding value of a substance, and this varies greatly according to the age, sex, breed, &c., of the animal fed, and with the state of the food; whether it be grown in the cold or in the dry season, whether cut at an early period or when it has attained maturity, whether fed in a green state or after being made into hay, &c.

Feeding of the cattle.

106. During the year the food principally given to the cattle was ground-nut oil-cake; 4 lb. of cake was generally allowed per head, but to this 2 lb. of grain per head was added when there was great pressure of work, as is usually the case during the sowing season. Besides this each bullock received about 30 lb. of chaff or green fodder daily. The cows were almost always supplied with green fodder, as they yield more milk when fed with it than with dry straw; as the Guinea-grass always produced some food during the dry season, there was no difficulty in doing this. Sorghum straw cut green appears to be one of the best foods we possess for cows; they not only take it readily but they generally yield more milk when fed on it than on other food. The working cattle were during the year fed entirely in the boxes; there was always a sufficient amount of fodder in the yard to make grazing in the field unnecessary. By housing the cattle during noontime more manure is obtained, and the cattle are in a better state for work when fed under shelter than when they are obliged to seek their food during the great heat of the day.

107. In the table given below the number of stock maintained on the Farm during each month of the year is given, and their equivalent as country cattle of 300 lb. live weight:—

Months.	Cattle.	Sheep.	Pigs.	Equivalent as Country Cattle.
1878.				
April	31	279	...	118
May	31	268	...	116
June	31	268	...	116
July	32	266	...	117
August	33	262	...	118
September	33	260	...	118
October	36	256	...	123
November	36	245	7	125
December	36	243	7	125
1879.				
January	38	249	7	130
February	38	282	6	135
March	37	274	6	132
Average ...	34	263	3	123

The actual cost incurred for feeding these animals with purchased food is given below :—

	Rs.	A.	P.
91,142 lb. ground-nut-oil cake	1,833	0	1
2,978 lb. bran	70	0	5
22,460 lb. paddy straw	71	3	9
490 lb. salt	16	8	6
Rupees ...	1,990	12	9
Deduct one-third chargeable to manure	663	9	7
Actual cost of feeding stock equal to 123 head of country cattle	1,327	3	2

The price paid during the year for ground-nut-oil cake remained high.

108. In the following table the cost of feeding our stock during each of the past three years is shown, together with various other details of interest :—

—	1876-77.	1877-78.	1878-79.
Live stock maintained calculated as country cattle ...	132	135	123
Percentage of deaths	7·5	12	8·6
	As. P.	As. P.	As. P.
Cost of purchased food a head per mensem	8 6	10 6	14 5
Stock, as country cattle, per 100 acres of cultivable land.	82·5	84·375	84·24

SECTION VI.

IMPLEMENTS AND MACHINES.

109. *Swedish Ploughs.*—During the extremely dry weather of the year, the utility of the ploughs imported from Sweden was repeatedly demonstrated; by using heavy ploughs, field operations could be performed at almost any time during the year. Nearly all the fields that carried a cold weather crop were ploughed during the month of March, and, owing to the exceptional nature of the season, it has been possible to continue the work in April, so that if there should be rain in May none of the best time for sowing will be lost in breaking up the soil.

Utility of having heavy ploughs.

110. *American Plough.*—The light plough, imported from America some years ago, and referred to in paragraph 135 of the report for 1874-75, was in use nearly throughout the whole year; it was worked as a swing plough. This is a useful implement for light soils; being very light, it can easily be carried by the ploughman on his shoulders when going to and from the field.

111. *Collins' Ploughs.*—Two ploughs by these makers were sent to the Farm during the year for trial. Both were swing ploughs; one was fitted with a revolving coulter; the second had no coulter at all. The ploughs were tested in a field, the soil of which is a friable sandy loam, but intermingled with pieces of bricks, the place having been a tile-yard previously. The plough fitted with a coulter worked very steadily, the coulter acting as a wheel; at first when the coulter was lowered and its edge fixed close to the share, pieces of bricks, which forced themselves between the share and coulter, not only stopped the turning of the coulter but also impeded the action of the share and increased the draught; however, on raising the coulter a little, the plough worked very smoothly. The second plough, without a coulter, did not work satisfactorily; the driver had great difficulty in managing it as he could not keep it steady, the plough having a great tendency to go downwards, a defect which could be remedied by fitting it with a wheel.

The following table shows the result of the trial; for the sake of comparison an English plough was tested under the same condition:—

Ploughs.	Average		Soil moved per 100 yards run.	Draught.
	Depth of furrow turned.	Width of furrow turned.		
	INCHES.	INCHES.	C. YDS.	LB.
Ransome's light iron; fitted with wheel...	7·8	11·5	6·92	358
American; with revolving coulter ...	7·8	10·3	6·20	336
American; without wheel	8·14	10·14	6·37	308

112. *Eagle Chaff-cutter.*—This chaff-cutter was imported from America four years ago, the cost, delivered at Saidapet, was Rupees 45. A chaff-cutter after this pattern is being made on the Farm, the cost of which will be about Rupees 36. This is a most useful machine, and one well adapted for ryots possessing not more than twenty head of cattle, for which it would easily prepare all the chaff required. An experiment was made to ascertain the amount of fodder that could be chaffed by it in one day, and the cost of doing it; the following is the result:—

	AS.
Cost of 1 cooly	3
Do. 1 boy	2
Do. oil, wear and tear	1
Total ...	6

The amount of fodder chaffed was 790 lb., so that the cost of chaffing was Rupee 1-1-0 per ton; a very moderate cost, and if the machine were used regularly it would soon be paid for by the saving of fodder effected in giving cut fodder to the cattle instead of uncut.

113. *Eagle Maize-sheller.*—This machine was also imported from America with the chaff-cutter. The whole machine is very simple and light and is well adapted for the use of small landholders; its price also is very moderate. The following figures show the capabilities of the machine and the cost of working it:—

	AS.
Cost of 2 boys	4
Do. oil, wear and tear	1

76,429 maize cobs were shelled in one day, which yielded 7,582 lb. of grain. The maize used was country maize, and as the machine is fitted for large cobs, the cobs had to be put through the machine twice; the figures are not so favorable as they would have been if large cobs had been used; the machine can however easily be so altered as to be fit for shelling large and small cobs.

114. *Hand seed-drill.*—A small hand drill was obtained during the year. The machine is very useful for sowing small areas in a garden as also for sowing blanks in fields. The feeder can easily be arranged to sow large as well as small seeds. It requires however some practice to work it properly, especially to deposit the seed at a proper depth; but in the hands of a careful man it would effect a great saving of time as it makes its own furrow to deposit the seed in and also covers it again, by means of some prongs attached to the machine, after the seed has been deposited.

115. *Double Mhote.*—This water-lift continues to give most favorable results. The only drawback connected with it is that the buckets and ropes have to be replaced frequently. To endeavour to remedy this defect, leather ropes and buckets, such as are in use near Ahmedabad, are now being experimented with, and if the results should be found satisfactory, all the fibre ropes and iron buckets will be substituted by leather ropes and buckets.

SECTION VII.

IMPLEMENT WORKSHOPS.

116. During the year the following implements were sold and sent to the districts named :—

Districts.	Iron Ploughs (from Sweden).	Iron Ploughs.	American Ploughs.	Ploughs.	Scythe.
Madras	...	...	1	...	...
Chingleput	2	...	2	1	...
South Arcot	...	1	...	...	...
North Arcot	...	...	1	...	...
Tanjore	...	...	1	...	...
Tinnevelly	...	...	2	...	...
Bangalore	...	...	...	...	1
Kaira	...	...	5	...	...
Total ...	2	1	12	1	1

117. The following are the accounts of the year. It will be seen that the deficiency against the shops since their commencement was slightly reduced during the year :—

Statement of Income and Expenditure for the Year ending 31*st March* 1879.

Income.	RS.	A.	P.	Expenditure.	RS.	A.	P.
Machines	396	14	0	Carpenters, Smiths and Filer ...	639	13	3
Materials	435	5	10	Cooly labor	227	6	0
Labor	888	10	9	Plant and Materials	797	13	1
Capital advanced	9	1	9	Interest	65	0	0
Total ...	1,730	0	4	Total ...	1,730	0	4

Balance Sheet on the 31*st March* 1879.

Liabilities.	RS.	A.	P.	RS.	A.	P.	Assets.	RS.	A.	P.	RS.	A.	P.
Capital advanced on 1st April 1878 ...	1,842	10	1				Valuation—						
Advanced during the 12 months ending 31st March 1879.	9	1	9				Buildings ...	431	0	0			
							Plant	208	4	0			
							Materials ...	233	15	0			
							Implements on sale.	331	8	0			
				1,851	11	10					1,204	11	0
							Outstanding bills ...	...			207	8	11
Labor due for March.	...			75	9	9	Deficiency	...			515	1	8
Total ...	...			1,927	5	7	Total ...	...			1,927	5	7

SECTION VIII.

ESTATE.

Land taken up to prevent nuisance.

118. A small piece of land, forming part of the bed of the Adyar, on the south-west boundary of the Farm, was added to the estate during the year. This land had evidently belonged previously to the Farm estate, but was not made use of on account of the poor nature of the soil and the uncertainty of getting a crop, the land being situated at a very low level and exposed to the river floods. The land not being used by the Farm, some persons took it up and, after cultivating it for several years, constituted thereby a claim to ownership. The land however became a source of great nuisance; it was used as a latrine by the many persons who came to the river for the purpose of washing clothes and removing sand, and thus rendered the neighbourhood insanitary. As the plot adjoins the site for the Agricultural College, and the house of the Superintendent, Government Farms, it was considered advisable to place it in the hands of the Department. The land has been cleared of part of the bushes with which it was covered and fenced in by a bank and aloe hedge.

Aloe fencing.

119. The part of the Farm bounded by the Roshumbaugh village had been fenced in during the last year. The fence consists of a bank raised from 3 to 4 feet above the surface of the ground according to its level; the soil required for raising the bank being obtained by excavating a drain on both sides of the bank; the top of the bank was planted with aloes. The work was done by contract; the cost of it was 1 anna a running yard, for a bank 1 yard high and 9 feet wide at the base and 2 feet at the top; the contractor supplying the aloe plants, and turfing the sides of the bank. It has been found that aloe hedges can be raised at a much less cost than corkapilly ones, as they require little attention after being planted, and when once grown up are well adapted to prevent the trespass of animals.

System of raising plants.

120. *Casuarina Plantation.*—A large number of casuarina plants have been raised during the year on the Farm. The seed was purchased at the rate of Annas 8 per pound from persons who collected it in the neighbourhood. The seed was sown in small beds, about 10 feet long and 5 feet wide; these beds were prepared just as if for sowing tobacco, and the seed was sown on the surface, and then covered slightly with some compost made of fine soil and well rotted manure, some cut-straw or refuse from the yard being spread over the beds to prevent surface crusting and to protect the seedlings from the sun. Usually about $\frac{1}{2}$ lb. of seed was sown in one bed, from which about 1,000 plants were raised. The plants appeared above ground in about two weeks after sowing; they were frequently watered at first, but when about 6 inches high only occasionally, and they were fit for planting out when about three or four months old. The cost of raising 1,000 plants fit for transplanting was about Rupees 2, which is very moderate; the usual market price of plants being Rupees 5 per thousand; this cost even could be much reduced, if plants were raised on a large scale. On the Farm about 60,000 casuarina trees were raised during the year; to raise them four coolies were employed for about four months in preparing the ground, sowing, watering, weeding, &c. To raise twice the number of trees only an additional cooly would have been required, reducing thereby the charges per thousand considerably.

Cost of plants.

System of planting out.

121. The plants were transplanted into the field on cloudy days in the month of December. The land on which casuarinas were planted was prepared as follows: After ploughing twice it was harrowed and ridged; the ridges were made as usual about 2 feet apart from

centre to centre. The seedlings were planted on alternate ridges. A boy in advance marked off the ridges with a stick at every yard length; a cooly following with a hoe made a hole from 9 to 12 inches deep at the spot marked; a boy following laid a plant in each hole, and a cooly coming behind, after having filled the holes partly with fine soil, planted the trees, and the whole were watered by women immediately after planting. In this manner each tree occupied about twelve square feet; the cost of planting including the first watering varied between 10 and 12 annas per thousand trees; which is certainly very low.

Castor beans sown to produce shade.

122. No manure being available at the time, the seedlings were not manured, but manure will be applied as a top-dressing. The ridges between the lines of casuarinas were sown with castor beans. Nearly all the trees planted took root, and, where some of them died, they have been replaced by fresh trees, and the whole promise to do very well. The castor beans germinated very well, but, as it was rather late when the seed was sown, the soil being very poor, and the weather unfavorable, they did not attain a great height; if the season had not been so very exceptional the castor plants would have grown large enough to afford shade for the trees and the yield of beans would have paid all the expenses for watering during the first year.

123. The casuarinas were planted more closely than in previous years; this was done partly for the sake of the shade the trees will afford each other and thereby be able to protect themselves better from the sun than when planted far apart, but chiefly to induce the trees to grow straight and upright, it having been observed that, when casuarina trees are planted far apart, instead of developing a straight stem their main stem is sometimes liable to fork and to produce many side branches, but no proper main stem, which considerably reduces the value of the tree.

Cost of planting.

124. In giving each tree 12 square feet, 3,630 trees can be planted on an acre of ground, which would involve according to the expenditure incurred in planting on this Farm an outlay for—

	Rs.	A.	P.
Preparation of the land by the plough	3	0	0
Raising plants	7	4	0
Planting, including first watering	2	12	0
72 cart-loads of manure including carting and spreading.	36	0	0
Total Rs. ...	49	0	0 per acre.

This cost for planting one acre is very moderate; but to it must be added the charges for watering, weeding, &c., for the first year, after which time the trees will require but little attention. It is difficult to estimate the exact charge for watering, as it depends on the nature of the weather; on the facility with which water can be obtained; and whether the soil is in good manurial condition, &c. Under favorable circumstances, especially when some other crop is raised between the lines of casuarinas for shading them, Rupees 20 may suffice, but, under unfavorable conditions, as much as Rupees 100 may be required for watering an acre during the first year after planting.

Cost of watering.

125. In the nursery beds besides the 60,000 casuarina trees referred to seedlings of the following trees have been raised :—

Albizzia speciosa	... Wild cassia.
Melia Indica	... Nim or Margosa tree.
Acacia Arabica	... Babool tree.
Bassia longifolia	... Illoopei tree.
Cassia tora	... Narrow-leaved cassia.
Syzygium jambolanum	... Blue plum.

None of these trees have been planted out as yet as the plants are very young and consequently small and the weather unfavorable for planting.

126. A large number of corkapilly (*Inga dulcis*) seedlings were also raised in the nursery. The ground was dug over about 1 foot deep and then heavily manured. The seed was then sown in lines 9 inches apart in small beds; after sowing the beds were watered at first every day, and after the seed had germinated every second or third day until the plants were about 6 inches high, when gradually the supply of water was diminished, and when about 1 foot high watering was discontinued. This stopped the growth of the plants, but they still remained green; they were then transplanted out to form a hedge. In a few small beds enough plants were raised to form a hedge 500 yards long. Nearly all the plants grew after being transplanted; water was applied occasionally. By this means a cheap hedge can be raised very conveniently in a short time; the planting may be performed at any time during the dry season when there is little circulation of sap in the plants. This experiment having given very satisfactory results, some fresh beds have been sown to raise plants for some new hedges, as well as for filling gaps in the old ones.

Raising Corkapilly seedlings for fences.

127. It is intended to enlarge the nursery for educational purposes, and to raise a greater variety of trees for the instruction of the students of the School of Agriculture. If in other countries, where the management of private plantations and forests is under the strict control of the State, it is considered necessary that, besides forest schools, the Agricultural Colleges should afford instruction in raising and maintaining plantations and forests, then it cannot be considered superfluous to do something in this country where the existence and judicious maintenance of arboraceous plants can influence to so great a degree the agricultural conditions we meet with.

Necessity for education in forestry.

128. *Permanent Improvements.*—The greater portion of the buildings, situated on the land set apart for grazing purposes, have been removed; only one of the sheds has been retained; this has undergone a thorough repair and a tile roof has been substituted for thatch; this shed has been used several times for curing tobacco for which it is tolerably well adapted. The slopes of the irrigation channel at the west side of the Farm were planted with Guinea-grass when the weather was too wet to perform ordinary field operations; although nearly all the roots sprouted, a great difference was observable between the plants growing on the two sides of the channel. The grass grew much better on the slope exposed to the morning sun than on that exposed to the evening sun. This may perhaps be attributed to the sudden changes of temperature, which the soil exposed to the morning sun undergoes; as it is well known that a soil whose temperature often and suddenly changes is more quickly improved than one undergoing similar changes of temperature gradually. The cattle boxes have been put in thorough repair; the feeding troughs are now all built of brick-in-lime, and the division and outside walls are built with drainage pipes inserted in the walls, and are thus perforated and ample ventilation is obtained. The cattle are now most comfortably housed, none of them having been sick during the whole year. A concrete channel was built along the side of the yard, forming a boundary to it and admitting of water being conducted to the yard from the water-lift close by; by this means most of the cocoanut trees planted in the yard can be watered by gravitation. Most of these trees which were planted recently in the yard grew very well during the past year; they were once severely attacked by white-ants, but a heavy dressing of common salt stopped the work of the insects at once.

(Signed) K. SCHIFFMAYER,
Assistant Supt., Govt. Farms, in charge.

SAIDAPET,
26*th May* 1879.

GENERAL WORK OF THE DEPARTMENT.

1. *Correspondence.*—No diminution has taken place in this branch of our work, by its means a great amount of valuable information is annually diffused to persons taking an interest in land-management, planting, and agriculture. The following are some of the subjects on which advice has been sought:—

Subject of Question asked.	District whence received.
The means of getting Apple tree scions for grafting	Punjab.
Soils best suited for the cultivation of Wheat and the best season for sowing it	Coimbatore.
The method of raising a mixed crop of Cotton and Maize with the best advantage	Do.
The means of getting rid of the surplus vegetation on grazing lands infested by noxious insects	Madras.
The working capabilities of well-augers, and the nature of labor needed for their working	Do.
Whether the ryots of Chingleput distinguish between "Smut" and "Ergot"	Tinnevelly.
Fibre plants and oil-cake	Madras.
Whether the extraction of the oil found in locusts would prove a profitable undertaking, and the working capabilities of a Double Mhote ...	Madura.
The liberal privilege allowed by the State to the ryots of Kistna District as regards pasture land for the stock of the village on favorable terms of rent	Madras.
Information regarding Wind-mills	Guzerat.
Cultivation of Buckwheat as a fodder-producer	Kistna.
Opinion as to the cause of damage done by insects to certain heads of Cholum	Coimbatore.
Cotton culture	Cochin.
Cultivation of Guinea-grass	Malabar.
Opinion as to the quality of China Bean cake for feeding purposes ...	Madras.
Opinion as to the number of mares a donkey stallion would serve in one year in a season of three months	Do.
Introduction of Pekin Ducks on the Nilgiris	Ootacamund.
Books to be read to gain a general knowledge in agricultural matters, and the means of obtaining exotic agricultural seeds	Madura.
Works to be consulted to obtain a good information regarding the soils and manures especially suited to particular trees, vegetables, fruits and flowers, &c.	Madras.
The cost of maintaining an Agricultural College, and its general management	Poona.
Information as regards the outturn and value of Sugar and Indigo per acre	Chingleput.
The outturn of irrigated and unirrigated cereals and pulses per acre in India compared with that of England and America	Madras.
Method of storing Indigo seed in view to preserve its vitality	Do.
The success attending the raising of grasses from seed obtained from Queensland	Do.
Means of removing impurities from the gram supplied to the horses of the Commissariat Department; and the cost of the machine used in removing such impurities	Do.
Estimates for starting a Farm and a School of Agriculture in connection therewith	Guzerat.
Means of obtaining certain agricultural seeds and buffalo-grass roots ...	Nilgiris.

Subject of Question asked.	District whence received.
Means of obtaining wheels and their cost	Indore.
The utilization of Guindy Park in a stock-breeding experiment ...	Official.
The results of a further trial made with the double mhote with new and large buckets	Madras.
Curriculum and cost of the Madras Government School of Agriculture ...	Poona.
Experimental culture of "Sorghum Saccharatum" and "Planter's Friend" on the Shevaroys	Salem.
The working capabilities of a plough and the means of obtaining one of the best description to be used on red soils	Kistna.
Cost of constructing a double mhote	Madura.
Coffee-planting	Salem.
Ornamental gardening	Central India.
The outturn of Tanjore paddy land	Madras.
The richness of the dung of milch-cows when young or milking, or that of growing animals compared with the dung of other cattle, and the bearing it has on the question of grazing the rough pasture of this country ...	Nilgiris.
The supply of ploughs of European pattern with their price, &c.	Burdwan.
The cost of constructing a double mhote and its working capabilities ...	South Arcot.
Proposed experiment with a small herd of the Amrut Mahal breed of cattle on the Nilgiris or in the Coimbatore District	Official.
Seed affected by disease and the causes that lead to its infection ...	Bombay.
Cost of a double mhote	Salem.
The value of dried cattle-dung and dried bones and lime as manure ...	Tuticorin.
The districts in Madras Presidency which produce the best cotton; the comparative superiority of the cotton of Bellary, Coimbatore and Tinnevelly; the original habitat of the cotton plant; the characteristics of good cotton; the towns to which—in India and in Europe—the cotton from the Presidency is exported; the price of first and second-sort cotton per maund; the price of cotton-seeds per maund or measure; the description of cotton-seeds to be cultivated in the Punjab, Cashmere and Moradabad; whether the American or Egyptian varieties are good and whether they can be cultivated in any suitable land	Madras.
The establishment of Model Farms	Burmah.
Description of crops to be cultivated in a certain coffee estate with advantage and the time best adapted for their cultivation; description of manure to be used for coffee to obtain a good crop; the description of scythe to be employed in cutting weeds on coffee estates and its cost	Madura.
Opinion as to the working capabilities of certain ploughs sent by Messrs. Oakes and Co. for trial; and as to their general usefulness in this Presidency	Madras.
Means of obtaining a bone-mill	Do.
The value of distillery refuse as a manure	Do.
Information regarding the work of the School of Agriculture and the rules under which students are admitted into it	Punjab.
Culture of arrowroot and the manure to be used for mango trees ...	Tanjore.
Means of getting rid of rats committing great havoc to crops	Dharwar.
Information regarding the work of the School of Agriculture	Cawnpore.
Information regarding the conditions under which students supported by Native States are admitted into the School of Agriculture	Travancore.
Opinion as to the value of certain manure, the analysis of which was sent for inspection	Madras.
Information as to the grass-seed that will give a respectable sod ...	Chingleput.
Works to be consulted to gain a knowledge in the principles of agriculture	Salem.
The working of a bucket-pump; and the relative merits of Guinea-grass and Buffalo-grass as regards hardihood, quality and quantity of produce	Do.

The correspondence with the Board of Revenue is still large. During the year 184 letters were addressed to that body on various matters, departmental and agricultural. The following are some of the chief subjects referred to:—

Subjects.	Disposed of in the Board's Proceedings.	
	Number.	Date.
Enclosing extracts from a Report by the Commissioner for Agriculture, United States, affording useful information relative to the Migratory locust usually called Grass-hopper in the United States.	1,060	17th April 1878.
Report on the result of a small experiment made in Jute cultivation on the Saidapet Experimental Farm	1,124	29th April „
Forwarding an extract from the Annual Report of the Commissioner of Agriculture for the United States, affording information regarding the habits of the Migratory locust	1,151	1st May „
Submitting a report on the subsoil drainage experiment made on certain land in the Kottur Village of the Saidapet Taluk ...	1,326	16th May „
Submitting a report regarding the cost of making a plough of the Swedish pattern	1,925	11th July „
Report on the subsoil drainage experiments conducted on the Saidapet Experimental Farm	2,004	19th July „
Enclosing copies of reports affording information regarding the results of further attempts in cultivating *Sorghum saccharatum* and Planter's Friend in this Presidency	1,973	16th July „
Submitting a report as to the steps taken to impart to the Agricultural Community generally the lessons to be learnt from the operations conducted on the Saidapet Experimental Farm ...	2,112	31st July „
Suggesting that one of the Assistant Superintendents of Government Farms should perform a tour in some of the districts to acquire more detailed knowledge of local customs of the ryots by personal observation	2,442	3rd September 1878.
Forwarding an extract regarding the preparation of artificial Indigo.	2,684	1st October „
Submitting observations regarding the subject of establishing a Juvenile Criminal Reformatory for the reception of youths of the criminal classes on the Saidapet Farm	2,988	7th November „
Remarks regarding the agricultural condition of the Madras Presidency in 1872 compared with that of 15 years previous ...	3,030	12th November „
Remarks regarding the rainfall in the months of October and November 1878 compared with the average of the previous 8 years.	3,436	19th December „
Report regarding the results of the physical training of the students of the School of Agriculture	319	6th February 1879.
Suggestions for exhibiting the working of European ploughs to the ryots in the districts	375	11th February „
Suggesting that the attention of the Court of Wards and the Zemindars of this Presidency may be invited to the facilities the School of Agriculture affords for training Agricultural Instructors for future employment on the different Estates under their management	536	28th February „
Suggesting the Prize-Farm System for promoting good farming in this Presidency	682	14th March „
Explanations with reference to the Board's review of the report of the Department for the year ending 31st March 1878 ...	698	15th March „
Submitting an estimate showing approximately the cost that would be incurred in exhibiting the working of four improved ploughs in the District of Trichinopoly	691	15th March „
Information regarding the crops produced and the stock maintained on the Saidapet Farm during 1876-77 and 1877-78	732	19th March „

Extracts from the correspondence will be made and printed with this report.

2. *The Famine Commission.*—A portion of the series of questions propounded by this body having been referred by Government to this Department for reply, a memorandum was prepared and forwarded to Mr. G. A. Ballard in September 1878. It dealt chiefly with the following subjects :—

Rain required for the growth of our common crops under ordinary systems of cultivation, and under improved agriculture.

The benefits that deep cultivation can confer on the country by storing up and fully utilizing the rain that falls, and so averting the usual effects of drought.

Injurious effects of floods, and water in excess in other forms.

Great increase of population with corresponding extension of cultivation showing that the resources of the country are decreasing under the native system of agriculture.

System of collecting statistics unsound, and statistics unreliable.

Estimate of the food produced in the Presidency.

Produce per acre contrasted with the outturn obtained in Europe.

Value of wells in a time of drought, and the small area irrigated from them.
Proportionate areas under different food-grains and their nature.
Population supported in the Madras Presidency per square mile not large.
The use of manure in native agriculture ; the substances chiefly relied upon; the area usually manured, and the amount available, with notes on manures still unutilized.
Absence of any system of rotation of crops, or of fallowing.
General belief in the exhaustion of our arable soils, and facts supporting the belief.
Decrease in proportion of live-stock maintained to the arable area.
Reasons for believing that a very large area of jungle has been felled during recent years, and the effects which this clearance must have had on the climate.
Necessity for extensive planting throughout the Presidency, and the advisability of rendering it obligatory on Government ryots to plant a portion of their holdings annually.
Irrigation water supplied should be paid for according to the amount consumed.
Small value of canal water, and its nature as its stimulant.
Necessity for providing adequate drainage.
Irrigation has extended the area under paddy—a low type of crop.
Backward state of Indian agriculture, and the necessity for improving it.
Early attempts of Government for improvement, which ended in failure.
The opening of the Saidapet Experimental Farm, and the work done since the year 1868.
Foundation of the School of Agriculture in 1876, and the advantages of general agricultural education.
Difficulty of showing the results of operations for the improvement of agriculture in a short time.
Necessity for demanding in Revenue Officers a knowledge of the principles of agriculture.
Greater prosperity to be hoped for from the improvement of the system of agriculture than from any extension of irrigation.

3. *Publications.*—A compilation from the reports of this Department has been made, and is ready for publication under the title of "The Saidapet Farm Manual and Guide."*

"It was prepared in order to bring together, in a form convenient for reference, the most interesting and valuable writings, referring to the practice of agriculture in this Presidency which are to be found scattered through the annual and special reports, submitted by the agricultural officers of the Madras Government during the past ten years; many of these reports being either out of print or otherwise not available to the public. A short guide to the Saidapet Experimental Farm has been added to the compilation in order that the farmer and agricultural student may be able to comprehend the circumstances under which the results and experience narrated have been gained."

The practice of making extracts from the various newspapers, &c., supplied to this Department, for publication as a supplement to the *Chingleput District Gazette* has been continued during the year. It is to be regretted that so beneficial a custom is not extended to all District Gazettes.

4. *Distribution of Seeds and Models.*—The following seeds were distributed gratis by the Department during the year :—

Districts.	Sorghum.	Planter's Friend.	Yellow Cholum.	White Cholum.	Maize.	Cotton-seed.	Carolina Paddy.	Tobacco.	Corcapilly-seed.	Red and White Wheat.	Sundries.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.	OZ.	LB.	LB.	LB.
Madras ...	21	21	...	...	1	10	11	2½	6	...	2
Chingleput ...	...	...	2½	...	3	32	5	...	...	...	18¼
Madura ...	5	...	¼	...	¾	30¼	...	...	...	...	¼
Coimbatore ...	...	...	...	...	1	2	...	...	...	115	...
Tanjore ...	2	...	...	...	3¾	...	...	...	...	...	...
Salem ...	...	...	...	...	...	2	...	2	...	...	...
Travancore ...	½	...	...	...	...	¾	...	...	5	...	1½
Nilgiris ...	...	...	...	...	...	...	...	...	...	200	...
Bellary ...	...	...	...	...	...	...	...	...	10	...	...
Vizagapatam ...	...	...	...	...	1	...	...	...	...	...	...
Ganjam ...	...	...	...	...	½	...	...	...	...	...	1½
Godavari ...	...	...	...	...	...	...	...	1	...	...	...
South Canara ...	50	30	...	...	...	...	...	...	...	...	...
Bombay ...	...	...	...	...	...	...	2	3	...	...	...
Jaffna ...	1	...	1	...	½	2½	...	...	...	...	2
Assam ...	1½	1½	1½	...	...	3	...	...	...	...	...
Brisbane ...	...	...	...	...	...	...	1½	¼	...	...	9
Madagascar ...	...	...	...	...	...	...	..	...	...	...	26
Total ...	81	52½	5¼	...	11½	82½	19½	8¾	21	315	60½

* Published July 15th, 1879.

Models of the double mhote were also distributed free of cost to persons in the districts named as below :—

District to which sent.	Madras.	Salem.	Madura.	Trichinopoly.	Kurnool.	Bombay.	Ahmedabad.	Hoshungabad.	Wardah.	Chittagong.	Brisbane.	Total.
Number	2	1	2	1	1	1	1	1	1	1	1*	13

Iron ploughs of English pattern were supplied gratis to the following gentlemen :—

Rev. S. J. Chowreappah, South Arcot.
„ W. S. Howland, Madura.

5. *Exchanges.*—The following Societies and Departments promised during the year to exchange their publications with those of this Department :—

Director of Botanical Gardens, Calcutta.
Director of Agriculture, North-West Provinces, Allahabad.
Secretary, Horticultural Society, Madras.
Secretary, Horticultural Society of India, Calcutta.
Secretary, Indian Section, Society of Arts, London.
Secretary, Cobden Club, London.
Secretary, Highland Agricultural Society of Scotland, Edinburgh.
Secretary, Agricultural Society of New South Wales, Australia.
Secretary for Agriculture, Victoria, Melbourne, Australia.
Director of Botanical Gardens, Brisbane, Australia.
Director of Botanical Gardens, Adelaide, Australia.
Secretary, Queensland Acclimatization Society, Brisbane, Australia.
Superintendent, Royal Agricultural Museum, Berlin, Prussia.
Director of Botanical Gardens, Butenzorg, Java.
Ministers of Agriculture, Rome, Italy.
Professor of Agriculture, University, Tokio, Japan.
Principal of the Canterbury Agricultural College, Christ Church, Canterbury, New Zealand.

6. *Finances.*—The following is an abstract of the income and expenditure of the Department during the year :—

	RS. A. P.	RS. A. P.		RS. A. P.
Balance on the 1st April 1878 ...	...	1,91,215 13 7	*Expenditure*—	
Receipts—			General Supervision	20,782 8 3
Provincial Grant...	20,000 0 0	...	Saidapet Experimental Farm ...	12,181 12 4
Surplus Pound Fund	61,825 1 9	...	Implement Workshops	1,730 0 4
RS. A. P.			School of Agriculture	23,384 0 3
Saidapet Experimental Farm ... 2,539 6 2			Estate Improvements	4,261 5 8
Implement Workshops 1,720 14 7	4,260 4 9	86,085 6 6	Allowance to Surgeon for medical charge	848 11 4
			Expenditure incurred by Public Works Department for the Farm	482 2 0
			Paid by transfer	91 8 0
			† Balance in favor of the Department on 1st April 1879 ...	2,13,539 3 11
Total ...	...	2,77,301 4 1	Total ...	2,77,301 4 1

Under the heading "*General Supervision*," the expenditure during the year was Rupees 20,782-8-3, or Rupees 1,530-13-11, more than in the year 1877-78. The expenditure incurred on behalf of the *Saidapet Experimental Farm* was Rupees 1,186-6-0, more than what was expended last year; whilst Rupees 1,730-0-4 were spent to maintain the *Implement Workshops* against Rupees 2,030-10-5, the amount expended in the previous year. Rupees 14,801-6-1 were spent to meet the "ordinary" charges of the *School of Agriculture* against Rupees 13,544-9-1, the expenditure in 1877-78; and Rupees 6,999-4-0 were spent by the Public Works Department during the year for constructing a Laboratory and for providing temporary sheds. Under the heading *Estate Improvements*, the expenditure during the year was Rupees 4,261-5-8 or a little less than half of the expenditure incurred in the previous year. The Public

* 1 model of the picottah was also sent to Brisbane in exchange for seeds, &c., received.
† This balance is not absolutely correct, as some transfer accounts have not been settled by the Accountant-General.

Works Department also spent Rupees 482-2-0 for a channel from the Chembrambaukum Tank, which is as yet altogether useless. The total expenditure during the year was Rupees 63,762-0-2 against Rupees 62,911-13-5, the amount spent in 1877-78. Rupees 61,825-1-9 were received from the Surplus Pound Fund, which with Rupees 4,260-4-9, the amount realized during the year by the sale of Farm produce and of the machines, &c., manufactured in the workshops attached to the Farm, makes a total income of Rupees 66,085-6-6 against Rupees 56,938-6-3 received in 1877-78.

A statement of the accounts of the Department in detail is appended to this report.

7. *Establishment.*—No changes were made in the establishment during the year. I delivered over charge of the Saidapet Experimental Farm to Mr. Schiffmayer early in April, after which until the close of the year that officer remained in charge. After my return from privilege leave in July, Mr. Robertson availed himself of similar leave granted to him, and during his absence I officiated for him, as I did also during his deputation in Bombay. The conduct of the subordinates of establishment has, on the whole, been satisfactory.

CHARLES BENSON, M.R.A.C.,
Ag. Supt. of Govt. Farms, Madras.

SAIDAPET,
29*th May* 1879.

OUR FOOD-SUPPLY.*

1. The following figures show the proportionate area under the various cereal and pulse crops in the Presidency, and from them it will be seen that the chief food-grains are paddy, cholum, and cumboo :—

Area cropped with	Acres.	Proportion.
Wheat (*Triticum spelta*) ..	19,000	·10
Paddy (*Oryza sativa*)	5,584,000	28·02
Cholum (*Sorghum vulgare*) ..	4,610,000	23·13
Cumboo (*Penicillaria spicata*) ..	2,909,000	14·60
Raggy (*Eleusine corocana*) ..	1,636,000	8·20
Inferior cereals†	3,096,000	15·53
Pulses	2,077,000	10·42
Total ..	19,931,000	100·00

It may be noted that of all these crops the only one which especially needs manure is wheat, whilst the difference between the inferior cereals and the uncultivated grasses is, in the scale of vegetable life, infinitesimal; whilst I may quote here the following expression of opinion by Professor Church, of the Royal Agricultural College, Cirencester, regarding our pulses :—

"Many of the leguminous plants are little better than unimproved weeds."

2. Regarding the supply of food-grain in the Presidency, it may be observed that the population of the Government lands, that is of all the country excepting the Zemindaries, is about 24 millions; the consumption of food is probably not much less than 1·4 lb. of grain a head per diem, or 7 lb. by a family of 5 persons, making an annual demand of 120 million cwts. The amount of seed used per acre of arable land sown with food-grains is probably not less than 56 lb., or ·5 cwt., thus causing a demand on the Government lands of 10 million cwts. The annual exports and imports nearly balance each other, so that the total demand from the soil for the support of the population is about 130 million cwts. In the lands belonging to Government there are annually about 5 million acres under irrigated paddy, 13 million acres under unirrigated cereals, and 2 million acres under pulses. According to the best available data, those collected in making the settlement, allowing for bad years, and the preponderance of the poorer classes of soils, the following may be taken as the average outturns :—

	Cwts.		lb. per Acre.
Paddy	9	or	1,008
Unirrigated cereals	5·5	or	616
Pulses	4	or	448

At these rates the annual product of Government lands would be—

	Million Cwts.
Paddy	45
Unirrigated cereals	71·5
Pulses	8
Total Food-grain ...	124·5

This includes the product of second crop.

* The greater portion of this paper was laid before the Famine Commission.

† Including Varagu (*Panicum miliaceum*); Koralu or Tennai (*Panicum Italicum*); Shamai (*Panicum miliare*).

3. The area of the Zemindari lands is about $\frac{1}{3.27}$ of that of the Government lands, so that the product of them, assuming a similar proportionate area is under crop, may be taken as follows :—

	Million Cwts.
Paddy	14
Unirrigated cereals	22
Pulses	2·4
Total Food-grains ...	38·4

The lands which produced this food would require 3 million cwts. of seed-grain and sufficient food for a population of about 8 millions, or 37 million cwts., making a total demand from the Zemindari lands of 40 million cwts. The balance sheet of the Presidency may be shown as follows :—

—	Million Cwts.	Million Cwts.
Demand for food	157	..
Do. for seed-grain	13	170
Supply Government villages ..	121	..
Do. Zemindaries	38·4	159·4

Showing a deficiency of 10,600,000 cwts. or about 6 per cent., which is probably accounted for by too high an estimate of the daily consumption per head being taken. These figures agree with general experience, which has shown that the state of existence of the poorer ryots and laborers is usually one of simple subsistence only; a slight deficiency of crop causing them want; a large, starvation; there is no margin to lay by for evil times; and too often the ryot, who could lay by, spends his little savings in a marriage or a festival.

4. Mr. Robertson considered the figures given above to be high, and explained his reasons for holding such a belief as follows :—

"My own reasons for believing the figures given by Mr. Benson to be high average ones are :—

1st.—My general experience of the Presidency, now extending over ten years, during which time I have seen a considerable portion of the country, the knowledge thus gained having been supplemented by an extensive acquaintance with official records relating to the agriculture of the Presidency and by considerable opportunities for learning the opinions of men familiar with native husbandry from all parts of the Presidency.

2nd.—My special experience regarding the Coimbatore District, which it must be acknowledged is one fairly representative of the whole Presidency.

That the Coimbatore District is a fairly representative one the following facts will show :—

—	Coimbatore.	Average of the Presidency.
Population per square mile	237·3	226·2
Houses per do.	48·6	45·
Persons per house	4·89	5·02
Incidence of land revenue per head of population	RS. A. P. 1 6 8	RS. A. P. 1 6 8
Assessment per acre—		
Wet land	7 5 0	4 9 0
Dry land	0 14 3	1 1 0

That the cropping of the Coimbatore District is very similar to that of the rest of the Presidency the following figures, showing the percentage of area of each class of crop raised, will prove :—

Area under	The whole Presidency.	Coimbatore.
	PER CENT.	PER CENT.
Cereals	76·28	77·89
Pulses	9·05	8·90
Oil-seeds	5·54	3·44
Indigo	1·10	..
Cotton and other special crops ..	6·14	7·81
Garden crops	1·89	1·96
Total ..	100·00	100·00

The following figures have been compiled from a statement furnished me by Mr. Wedderburn showing the area cultivated in the Coimbatore District with each crop and the produce obtained during the Fasli 1284 (1874-75). Regarding the season of the year Mr. Wedderburn in his jamabundi report states :—"The past year was an average one." The figures are as follow :—

Description of Corn.	Area under Crop in Acres.	Total yield in Garce of 3,200 Measures.	Yield per Acre in Pounds.
Paddy	91,410	16,858	1,254
Dry Grains—			
Cholum	680,197	74,936	882
Wheat	2,235	138	495
Raggy	221,642	16,132	582
Varagu	8,143	348	342
Cumboo	812,991	30,989	305
Dholl	14,799	928	500
Tennai	38,521	1,675	347
Shamai	109,007	7,160	525
Average of all dry grains ..	..	..	560
Pulses—			
Oolunthoo or black-gram	7,987	183	219
Bengal-gram	9,684	222	219
Mochai or avarai	24,732	528	204
Horse-gram	157,996	4,781	291
Tattapairu	9,143	145	150
Naripairu	4,422	157	342
Patchaipayar or green-gram	9,698	179	177
Average of all pulses ..	..	..	267

The measure is taken in these calculations to hold—

$2\frac{1}{3}$ lb. of paddy.
$2\frac{1}{2}$ lb. of dry grain.
3 lb. of pulse.
} All high average weights.

From the above statement it will be seen that in this representative district the outturn of—

	LB.		CWT.
Paddy is stated to be	1,254	or	$11\frac{1}{4}$
Unirrigated—			
Cereals is stated to be	560	or	5
Pulses is stated to be	267	or	$2\frac{1}{2}$

In every case, excepting that of the *paddy*, the figures being considerably lower than those of Mr. Benson's estimate. That the outturn of paddy in this district should be higher than the average of the Presidency is not surprising, seeing that, as shown by the figures given above at paragraph 4, it is clear that the irrigated lands of the district pay a rent 60 per cent. higher than the average of the Presidency for similar lands.

The Board themselves, I believe, looked upon the Coimbatore District as being better farmed than the average of the Presidency, for in paragraph 7 of their Proceedings, No. 1,334, dated the 17th of May 1875, they particularly held it up as a specimen to be studied, and themselves selected it as the one in which I should first perform a tour."

5. The figures are moreover supported by the fact that, according to the Director of Revenue Settlement, in the Trichinopoly District, the outturns are higher than the average per acre of the whole Presidency, as the following figures show :—

	Average of the Presidency.	Trichinopoly.
	LB.	LB.
Paddy	1,621	1,678
Cholum	666	690
Raggy	770	834
Cumboo	630	638
Varagu	950	1,208

How these figures were arrived at, I am unable to state, but, as we do not know, nor have we ever known, the area of the different crops grown on the different classes of lands, it is manifestly impossible to calculate the average outturns by the crops individually, and the only reliable method for arriving at the true produce of food-grain is one similar to that adopted by me in my report of my tour in the Trichinopoly District (paragraph 10), where I have shown that, according to Mr. Puckle's figures, the average outturn in that district, which, be it remembered, produces more heavily than the rest of the Presidency, was in 1864 for—

	lb. per Acre.
Irrigated paddy (first crop only)	1,280
Unirrigated cereals	570

and that there is reason to believe that the present outturn is even less.

6. It has been said that, because my estimate shows a deficiency in the supply, my figures of produce must be wrong; but if I take the figures adopted by the Board of Revenue for the average daily consumption per head, viz., 1·25 lb. instead of 1·4 lb. which I assumed, the demand for food will be reduced immediately by 10·7 per cent. and the Presidency will be shown to have an annual excess produce of 6,199,000 cwts. of food-grain; an amount more than sufficient to account for the reserves which must have existed before the famine.

7. It may not be out of place to observe here that there is every reason to believe that the people of this country are not nearly so great vegetarians as is commonly supposed; that all excepting a few castes will eat animal-food, excepting beef, is well known, and the annual disappearance of at least one million head of goats and sheep, the natural increase of the herds, cannot be accounted for in any other way than that they are slaughtered for human food. The consumption in the city of Madras alone demands the annual slaughter of 8,000 bullocks and of 220,000 sheep and goats.

8. The use of fish as an article of diet is very general wherever it can be procured, and this fact points to the necessity that exists for the better utilization of the existing means of producing this valuable food. It is very generally admitted that during the famine our sea fisheries were not fully made use of. The means existing for pisciculture in our tanks, ponds, rivers, &c. are great, but unutilized.

9. Before concluding I would draw attention to the common mistake made in believing that India, or at least Southern India, supports a teeming population, or a population even in numbers alone in excess of that supported in some European countries. Of this the following figures are conclusive :—

	Population per Square Mile.
Madras Presidency	226·2
Belgium	471·0
Great Britain	297·6
Holland	285·8
Italy	268·0
France	176·7

In only one district of the Madras Presidency (Tanjore) is the population per square mile of Belgium exceeded, whilst in 13 it does not reach that of Italy.

But the annual consumption of food-stuffs per head of population is far greater in Europe than in India, probably at least double, so that India should be able to support a population twice as numerous as that of Belgium, whereas in Madras it only does about half. This is supposing that the percentage of cultivable land is the same, and that an equal proportion of land is devoted to industrial products, such as wool and textile or oleaginous crops, &c., and also that the land is capable of producing an equal outturn per acre if similarly worked.

10. How miserable is the yield of the staple crops of the Presidency has already been mentioned; the following figures give some details regarding the produce of crops in Europe :—

Country.	Average yield per Acre.	
	Wheat.	Pulses.
	LB.	LB.
Great Britain	1,800	1,700
Belgium	1,680	1,470
Holland	1,500	1,680
France	1,030	1,000
	CEREALS.	PULSES.
Madras	700	450

But the smaller yield obtained in this Presidency is not, I believe, due to the soil being of less natural fertility or the climate less favorable, but to a degraded agricultural system.

(Signed) CHARLES BENSON, M.R.A.C.,
Ag. Supt. of Govt. Farms, Madras.

SAIDAPET,
June 1st, 1879.

VARIATIONS IN THE COMPOSITION OF GRAIN.

1. The following extracts are taken from an essay by Professor Henry Tanner, M.R.A.C., published in the last journal of the Highland and Agricultural Society of Scotland. They are particularly interesting.

"The inquiry was also extended so as to include those cases in which by skilful management difficulties of soil and climate were surmounted, and to show the influence which was thus exerted upon the production of food. In one case we found the good and the bad management of land, fairly similar in natural character, and under similar conditions of climate, producing crops exceedingly different in quantity and quality. Under good cultivation we found 50 bushels of oats weighing 43 lb. per bushel, produced from one acre of land; and only 10 bushels, weighing 22 lb. per bushel, yielded by another acre of similar land. The chemical analysis of these specimens of oats gave the following results:—

	Composition of Oats grown under	
	Good Cultivation.	Bad Cultivation.
True albuminoid matters (gluten)	7·18	1·58
Starch, gum, &c.	61·69	64·49
Fatty matter	2·88	1·68
Cellulose	9·10	16·36
Nitrogenous matter (not true albuminoids)	3·32	1·21
Containing nitrogen	(·524)	(·190)
Alkaline salts in ash	1·20	1·05
Earthy salts in ash	·58	·82
Silicious matter in ash	·70	·88
Water	13·35	11·93
	100·00	100·00

The production of food in these instances also showed how greatly good cultivation enables the yield of corn to be increased in quantity, and at the same time that it becomes of greater value. The composition of the oats produced upon each imperial acre may be stated as follows:—

	Acreage yield of Oats under			
	Good Cultivation.		Bad Cultivation.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	154½		3½	
Fat and heat-producing matter	1,388¼		145½	
		1,542¾		149
Substances of little or no use as food—				
Cellulose, &c.	267		38½	
Mineral matter	53¼		6	
Water	287		26½	
		607¼		71
		2,150		220

Great as such variations as these are for the same extent of land, we shall obtain even more accurate ideas of the differences in the feeding value of the produce, by comparing the composition of one bushel of each growth:—

	Composition of one Bushel of Oats grown under			
	Good Cultivation.		Bad Cultivation.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	3		$\frac{1}{2}$	
Fat and heat-producing matter	28		$14\frac{1}{2}$	
		31		15
Substances of little or no use as food—				
Cellulose, &c.	$5\frac{1}{4}$		$3\frac{3}{4}$	
Mineral matter	1		$\frac{1}{2}$	
Water	$5\frac{3}{4}$		$2\frac{3}{4}$	
		12		7
Weight per Bushel ..		43		22

These results are peculiarly instructive as showing what most probably is the composition of the grain grown under the ordinary systems of culture in this Presidency, compared with what it might be if grown under good cultivation. It will be seen that not only does the crop grown under bad cultivation yield less, but the produce contains a smaller supply of nutriment and its composition is much poorer than when grown under good cultivation.

2. The following figures are interesting, as we have so much land which not infrequently suffers from supersaturation with water:—

"The influence exerted upon the quality and the yield of oats, by the more or less perfect drainage of the land, was also examined. The produce of two fields, having soils of similar character, and situated under similar conditions of climate, was found to differ as follows:—

The land, which had been properly drained, yielded 38 bushels of oats per imperial acre, weighing $42\frac{1}{2}$ lb. per bushel, whilst the undrained land gave only 26 bushels of oats, weighing 37 lb. per bushel. The chemical analysis of these specimens of oats gave the following results:—

	Composition of Oats grown upon	
	Drained Land.	Undrained Land.
True albuminoid matters (gluten)	7·79	7·03
Starch, gum, &c.	54·58	55·67
Fatty matter	4·23	3·56
Cellulose	14·86	14·90
Nitrogenous matter (not true albuminoids)	2·50	1·79
Containing nitrogen	(·395)	(·282)
Alkaline salts in ash	·42	·86
Earthy salts in ash	1·14	·72
Silicious matters in ash	·93	·78
Water	13·55	14·69
	100·00	100·00

From these data we are able to show the acreage of production of food in these two instances, and thereby indicate the difference which may be fairly traceable to the influence of drainage.

	Acreage yield of Oats grown on			
	Drained Land.		Undrained Land.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	126		67½	
Fat and heat-producing matter	949½		570	
		1,075½		637½
Substances of little or no use as food—				
Cellulose, &c.	280¼		160½	
Mineral matter	40¼		22¾	
Water	219		141¼	
		539½		324½
		1,615		962

The variations in the quality of the oats will be seen from the composition of one bushel of each of these crops:—

	Composition of one Bushel of Oats grown upon			
	Drained Land.		Undrained Land.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	3¼		2½	
Fat and heat-producing matter	25		22	
		28¼		24½
Substances of little or no use as food—				
Cellulose, &c.	7½		6	
Mineral matter	1		1	
Water	5¾		5½	
		14¼		12½
Weight per bushel ..		42½		37

3. The influence which the seed used has on the quality of the produce is clearly shown in the next extract:—

"One of the most interesting and probably one of the most important influences affecting the production and the quality of oats, is that exerted by the seed. We found land of similar character and under similar conditions of climate, producing crops differing from each other in a very marked degree, and in the case examined, that variation was fairly traceable to the influence of the seed. The chemical analysis of the corn so grown gave the following results:—

	Composition of Oats grown from Seed of	
	Good Character.	Bad Character.
True albuminoid matters (gluten)	5·89	2·72
Starch, gum, &c.	62·94	64·20
Fatty matter	2·81	3·92
Cellulose	11·70	12·98
Nitrogenous matter (not true albuminoids)	1·18	·50
Containing nitrogen	(·186)	(·079)
Alkaline salts in ash	·07	·50
Earthy salts in ash	·57	1·32
Silicious matter in ash	1·98	·90
Water	12·86	12·96
	100·00	100·00

The produce obtained from the seed having a good character was 35 bushels of oats per imperial acre, weighing 41 lb. per bushel, whilst the seed of bad character produced 22 bushels, weighing 20 lb. per bushel. The composition of the produce of one acre of each of these crops was as follows :—

	Acreage yield of Oats grown from Seed of			
	Good Character.		Bad Character.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh forming-matter	84½		12	
Fat and heat-producing matter	943½	1,028	295¼	307¼
Substances of little or no use as food—				
Cellulose	185		63¾	
Mineral matter	37½		12	
Water	184½	407	57	132¾
		1,435		440

The variations in the feeding powers of the oats so grown will be more clearly seen from a statement showing the food contained in one bushel of each crop :—

	Composition of one Bushel of Oats grown from Seed of			
	Good Character.		Bad Character.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	2½		½	
Fat and heat-producing matter	27	29½	13½	14
Substances of little or no use as food—				
Cellulose	5¼		3	
Mineral matter	1		½	
Water	5¼	11½	2½	6
Weight per bushel		41		20

In speaking of seed of good or bad character, I do not simply refer to that external appearance or condition which is generally observable, but also to that hidden constitutional character which subsequently enables the plant to struggle successfully against difficulties of growth. It is well known that seeds which differ but little in appearance, may have constitutional powers which will manifest themselves in unfavorable seasons, when the plant has to contend with adverse conditions. Nor must we limit the evidences of these influences to unfavorable seasons, although they give under such circumstances undeniable proof of their power, but we should, on the other hand, constantly acknowledge the truth of this hidden influence. In dealing with animal life we readily admit that we can intensify and render more permanent any desirable points of character. In vegetable life something has been done to establish in seed those distinctive characteristics which we desire to perpetuate, but very much more yet remains to be accomplished.

Closely associated with this influence, is that which arises from "change of seed," by which is generally understood making use of a suitable seed grown in another district, or upon soil of a different character. In the case examined we found that the crop of oats grown after a "change of seed" yielded 46 bushels of oats per imperial acre, and these weighed 43 lb. per bushel, whilst upon the same land the crop grown without such change of seed produced only 24 bushels of oats, weighing 32 lb. per bushel. The chemical analysis of these crops were as follows :—

	Composition of Oats grown	
	With change of Seed.	Without change of Seed.
True albuminoid matters (gluten)	7·66	5·23
Starch, gum, &c.	60·90	59·77
Fatty matter	2·45	4·07
Cellulose	11·55	15·10
Nitrogenous matter (not true albuminoids)	2·62	·48
Containing nitrogen	(·413)	(·076)
Alkaline salts in ash	1·41	·55
Earthy salts in ash	·35	1·31
Silicious matter in ash	·25	·91
Water	12·81	12·58
	100·00	100·00

The difference thus arising in the production is shown by a statement of the food produced by one acre of each crop :—

	Average yield of Oats grown			
	With change of Seed.		Without change of Seed.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	151½		40	
Fat and heat-producing matter	1,253		490¼	
		1,404½		530¼
Substances of little or no use as food—				
Cellulose, &c.	280¾		119¾	
Mineral matter	39¾		21¼	
Water	253½		96¾	
		573½		237¾
		1,978		768

For the convenience of examining the feeding value of these oats, the composition of one bushel of each growth is added :—

	Composition of one Bushel of Oats grown			
	With change of Seed.		Without change of Seed.	
	LB.	LB.	LB.	LB.
Substances useful as food—				
Flesh-forming matter	3½		1½	
Fat and heat-producing matter	27¼		20½	
		30½		22
Substances of little or no use as food—				
Cellulose, &c.	6		5	
Mineral matter	1		1	
Water	5½		4	
		12½		10
Weight per Bushel ..		43		32

4. These figures speak for themselves and do not require any comment; but they also show what necessity there is for obtaining detailed information regarding the grains of this country before one can speak of their feeding value, as is often done on the strength of the analysis of some museum samples. It also shows what a wide field for the research in agricultural chemistry exists here.

(Signed) CHARLES BENSON, M.R.A.C.,
Ag. Supt. of Govt. Farms, Madras.

SAIDAPET,
2*nd June* 1879.

THE GERMAN AGRICULTURAL EXPERIMENTAL STATIONS.*

By H. L. DeKLENZE, PH.D., M.A., *Director of the Royal Bavarian Experimental Dairy Station at Weihenstephan, Bavaria.*

Twenty-five years ago the first experimental station for scientific agriculture was instituted at Möckern, in Saxony, and it may not be uninteresting to look back at the development and the work of this and all the other German experimental stations during this last quarter of a century.

A new era for the advancement of agriculture began with our great Liebig, whose work "Chemistry in its relation to Agriculture and Physiology," came down like a stroke of lightning (A.D. 1840) amongst the scientific men of the age. But not only these took up his ideas, also practical men saw that through continued scientific research a foundation for the development of successful practical farming might be laid, because they then felt the want of knowledge and understanding of those physical, physiological, and chemical processes, which were passing every day under their very eyes. How can results be calculated if one does not know exactly the conditions under which they are attained!

In Saxony Petzhold and Stöckhardt began by lecturing before farmers on the above mentioned subject, and in 1845 a petition was sent by them and others to the Saxon Chambers, advocating the appointment of four chemists, each to lecture on agricultural chemistry, analyse soils and manures, and travel in one of the four provinces of the kingdom, to give advice to the farmers. This petition was not granted, however, as the persons in office did not think the right time yet come. This waiting and letting the fruit ripen too long, so that somebody else plucks it first, is one of our national faults, and an obstruction to rapid development. At the same time, the principal agricultural society of Saxony had reported to the ministry on the advisability of giving the agriculturists an opportunity to study agricultural chemistry; and in accordance with this proposal, after two years of deliberation, Stöckhardt was appointed Professor of Agricultural Chemistry at the Agricultural and Arboricultural College at Tharand, where he began work with investigations on forestry and physiology. In 1850 Councillor Reuning, then Secretary of the Saxon Agricultural Societies, began to open negotiations with different agriculturists to find a suitable farm on which chemical experiments could be conducted on a larger scale, and the result was that an experimental station was instituted at Möckern, a farm of sixty acres, near Leipsic, which belonged to the principal agricultural association of Saxony. As chemist Dr. Emil Wolff was engaged, who is now Director of the Experimental Station at Hohinheim, in Wurtemberg, and has spent half of his life in making thousands of analyses of feeding-stuffs, &c., and whose tables on the chemical and nutritive components of everything used for food are known and in use all over the world.

At first the new institution had only a private character; indeed, a large farmer, Mr. Crusius, paid most of the expenses out of his own pocket, but in 1852 help came from the State, and the agricultural societies and the experimental station at Möckern, the first in Germany, was instituted formally. The twenty-fifth year of existence of this first of the German experimental stations was duly celebrated in September last at Möckern, where many of the directors of German experimental

* Prize Essay from the journal of the Highland and Agricultural Society of Scotland, 1878.

stations met for this purpose. Both Stöckhardt, or as we disciples of his branch of science call him, "Papa Stöckhardt," and Wolff were present, both much moved by the reminiscences of these hard days when agricultural chemistry lay still in its cradle and by the warm and kindly greeting they received from old and young in the brotherhood. Also a lasting memorial was given to the guests in shape of a book containing all statistical and historical material which was available to give a history of the development of the German agricultural stations. It was written by Professor Nobbe of Tharand,* and its valuable material has been of much use to me in the compilation of these notes.

I will enumerate now the German agricultural stations and append some notes which show their year of foundation, the number of their directors and assistants, their yearly income and their fields of research:—

Name.	Year of Foundation.	Directors.	Assistants.	Yearly Income.	Researches are made on
Prussia.				Mark.	
1. Insterburg	1858	1	...	6,000	Chemical-technical subjects.
2. Konigsburg	1875	1	...	6,050	Technology and physiology of plants.
3. Danzig	1876	1 1	... ...	12,900	Climate and crops. Control of the seed-market.
4. Dahme	1856	1	3	12,300	Physiology of plants; controlling of seed-dealers; analyses of artificial manures.
5. Berlin	1874	1	2	15,300	Distillery and Zymotechnic.
6. Regenwalde	1863	1	2	7,000	Soils and physiology of plants.
7. Posen	1877	1 1	... ...	10,000	Feed of animals. Manures and cropping.
8. Zabikowo	1872	1 1	1 ...	6,575	Agriculture in general. Physiology and raising of plants; control of seeds.
9. Breslau	1877	(?)	(?)	(?)	(?)
10. Froskau	1869	1	3	11,400	Feeding and physiology of animals.
11. Froskau	1872	1	2	1,500	Diseases of plants, specially of fruit-trees.
12. Breslau	1875	1	...	1,000	Control of the seed-market.
13. Hallee	1855	1	4	31,600	Growing of crops; trials of artificial manures and feeding of animals; control of artificial manures.
14. Halle	1862	1	4	(?)	Pathology and physiology of plants; trials of manures.
15. Kiel	1870	1 1	2 ...	8,700	Physiology of plants; chemistry of animal elements. Dairying.
16. Kiel	1874	1	...	(?)	Control of the seed-market.
17. Gottingen	1857	1	2	8,310	Feeding of animals.
18. Gottingen	1876	1	...	(?)	Control of seed-dealers.
19. Hildesheim	1870	1	2 or 3	12,400	Manufacturing of beet sugar, and analytical methods.
20. Bremervorde	1876	1	...	(?)	(?)
21. Münster	1879	1	2	13,100	Control of the seed, manure, and food-markets.
22. Altmoroschen	1857	1	1	8,250	Physiology of plants; soils, and meteorology.
23. Marburg	1877	1	...	(?)	Control of the seed-market.
24. Weisbaden	1868	1	2	7,150	Chemistry of the vine and the fermentation, &c. of wine.
25. Geisenheim	1872	1 1	... ...	(?)	Physiology of the vine. The fermentation, &c. of wine.
26. Bonn	1855	1	1	10,000	General questions of agricultural practice.
27. Poppelsdorf	1868	1	2	4,200	Chemical and physiology of plants.
28. Poppelsdorf	(?)	1	...	(?)	Control of the seed-market.
Bavaria.					
29. Munich	1857	1	3	12,000	Analyses of artificial manures, food, &c.; experiments on physiology of cattle and plants.
30. Munich	1875	1	1	3,500	Cropping; agricultural physics.
31. Augsburg	1865	1	1	3,500	Control of the artificial manure and seed-market.
32. Weihenstephan	1866	1	1	According to want.	Brewery.
33. Munich	1866	1	4	21,000	Brewery.
34. Weihenstephan	1877	1	...	4,600 for current expenses, others according to want.	Dairy (scientific and practical researches on milk, butter, and cheese.)

* Festschriftzur Feier des 25 Jährigen Tubiläums der Versuchs—Station Möckern Die Landwirthschaftlichen Versuchsstationem, Bd. xxii, herausgegeben von Professor Dr. Nobbe. Berlin, 1877.

Name.	Year of Foundation.	Directors.	Assistants.	Yearly Income.	Researches are made on
Bavaria—(Continued).				Mark.	
35. Triesdorf	1874	1	1	1,500	General agriculture.
36. Bayreuth	1867	1	...	1,050	Manures, foods, and seeds.
37. Speier	1877	1	1	7,700	Agricultural and wine analyses.
38. Landshut	1876	1	...	(?)	(?)
39. Wurzburg	1877	1	2	2,300	Manure for vineyards; disease of vines; fermentation of the wine.
Saxony.					
40. Möckern	1852	1	3	14,892	Feeding of cattle.
41. Pommritz	1854	1	3	17,770	General agriculture.
42. Dresden	1862	1	1	3,000	Physiology and pathology.
43. Tharand	1869	1	2	6,515	Physiology of plants.
44. Döbeln	1872	1	1	1,962	Soils.
Würtemberg.					
45. Hohenheim	1865	1	2	12,000	Feeding and analyses of feeding.
Baden.					
46. Karlsruhe	1859	1	2	(?)	Vine culture and wine.
47. Karlsruhe	1872	1	1	2,400	Control of the seed-market.
Hessen.					
48. Darmstadt	1871	1	1	9,800	Manures.
Oldenburg.					
49. Oldenburg	1871	1	...	3,800	Soil.
Braunschweig.					
50. Braunschweig	1862	1	2	10,000	Chemical and technology.
Macklenburg.					
51. Rostock	1875	1	2	16,800	Physiology of plants and cropping.
52. Raden	1876	1	1	9,200	Dairying.
Weimar.					
53. Tena	1861	1 1 1 1	1 1 2 ...	2,500	Agriculture. Physiology of plants. Chemistry. Physiology of animals.
54. Zwätzen	1875	1	...	(?)	(?)
Gachsen Meiningen.					
55. Eisfeld	1872	1	...	600	Control of artificial manures.
Anhalt.					
56. Cothen	1864	1	1	7,700	Physiology of animals and plants.
Elsass—Lothringen.					
57. Rufach	1874	1	1	6,000	Physiology of plants and chemistry of wine production.
Bremen.					
58. Bremen	1874	1	3	17,400	Reclaiming of swamps, bogs, and other waste lands.
59. Leipzig	1875	...	...	...	Twenty-three agricultural colleges and experimental stations have united to try the different kinds of potatoes by experiment, and publish the results.

If we count up the annual expense incurred by the German agricultural stations as above mentioned, we find it at about 550,000 marks, but in a great many of these stations the salaries are paid from other sources and not included in the income mentioned; other stations have no settled income, but use as much as they want, and, considering these circumstances, I do not overrate the amount of money we spent annually on our stations when I put it down at 600,000 mark or £ 30,000. This is indeed a large sum, and if our stations had nothing else to do than to make researches on agricultural chemistry, I have no doubt that this whole branch of science would have been sifted to the very bottom, as far as the chemical knowledge of the day fallows it; for we cannot get much further in

physiology, for instance, if we do not find out the constitution, &c. of the albuminates. But these institutions are principally occupied with supplying local wants, in making analyses, and controlling the markets for artificial manure, feeding-stuffs and seeds. The adulteration of artificial manures was so effectually stopped by the stations that the dealers were compelled to submit to their regular control, so that an adulteration is now very risky as the buyers simply send a sample of the manure in question to the next station, where it is analysed, and defects are easily found out. It is the same with the seed-market. Every farmer knows that not all the seed is good which is offered, and that it only too often happens that seed is bought which has either lost all powers of germination, or which is largely mixed with seeds of weeds, &c. The larger dealers in agricultural seeds have now been obliged (by the *vox populi*) to submit to the control of the stations, who also in this case protect the interest of the practical farmer. The third market, the market of feeding-stuffs, had also been hitherto a bad one, because the farmer was without help against the adulteration of linseed and other cakes, and many other feeding-stuffs. Now the experimental stations control most effectively these three branches of business, all of which are so important for the practical farmer. No less than 33 stations are almost continually employed with controlling analyses of artificial manures; 29 with proving the purity and genuineness of agricultural seeds; and 27 with testing the quality of feeding-stuffs. It may be now understood why the adulteration of the above named substances cannot now gain ground, as such attempts are immediately followed by detection and punishment.

I come now to another part of the question, namely, the scientific work which the German stations have done since their institution, and to show the extent of it I must give a list of the different subjects which have been pursued by experiment, and of which a considerable number are solved, or partly solved, while others still remain in obscurity, and most probably will stay there for some time to come. This list was compiled by Professor Nobbe, and I give it here in translation :—

I. Sources of nourishment for the plants—
- *A.* Atmosphere.
- *B.* Water.
- *C.* Geological strata and the influence of the weather on them.

II. Arable land—
- *A.* Formation of soils.
- *B.* Physical and chemical character of the soils.
- *C.* Analyses of soils.
- *D.* Melioration.

III. Physiology of plants—
- *A.* Nourishment of the plants—
  - (*a.*) Mineral substances.
  - (*b.*) Compounds of the mineral substances as nourishments for the plants.
  - (*c.*) The roots in their action on the soil. Growing plants in solutions.
  - (*d.*) The organs of the plants which are above ground in their relation to the atmosphere.
  - (*e.*) Movement of nourishing elements in the plants.
  - (*f.*) Genesis, metamorphosis, and characteristics of the organic products of the plants.
- *B.* Influence of physical agencies on plants—
  - (*a.*) Germination (agricultural seeds, control of seeds).
  - (*b.*) Development of the organs.
  - (*c.*) Production of vegetable matter.
  - (*d.*) Reproduction.
- *C.* Diseases and misformations of the agricultural plants; destructive influences of parasites; destructive influences of fungi; destructive influences of animals.
- *D.* Chemical composition of the plants; General questions; Lichenes; Coniferæ; Gramineæ; Palmæ; Naiadaceæ; Cupuliferæ; Moreæ; Chenopodaceæ; Compositæ; Labiatæ; Solanaceæ; Umbelliferæ; Papaveraceæ; Cruciferæ; Ampelideæ; Coryophyllaceæ; Euphorbiaceæ; Drupaceæ; Papilionaceæ.

IV. Manuring—

Analyses of fertilisers:—

1. Stable manure, urine, compost.
2. Manure from closets and sewers.
3. Disinfectants.
4. Guano and other nitrogenous manures.
5. Offals from the industries.
6. Phosphates.
7. Gypsum, chalk, marl, mud from ponds and rivers.
8. Manure salts—
   (*a*) Potassic salts.
   (*b*) Other salts.
9. Other fertilisers in the market; control of fertilisers.

V. Field experiments—

A. On the effect of different fertilisers.
B. Raising and manuring Coniferæ; Gramineæ; Cannabineæ; Dipsacaceæ; Chenopodiaceæ; Solanaceæ; Umbelliferæ; Papaveraceæ; Cruciferæ; Linaceæ; Papilionaceæ.
C. Utilising manure.

VI. Parts and secretions of the animal body—

1. Albuminates.
2. Blood.
3. Flesh, &c.
4. Fats.
5. Wool.
6. Bones.
7. Horns, &c.
8. Milk.
9. Saliva.
10. Urine and excrements.

VII. Animal food and digestion—

A. Components of the feeding-stuffs—
(*a*.) Cereals.
(*b*.) Vegetables.
(*c*.) Hay, grass, and fermented food.
(*d*.) Roots and tubers.
(*e*.) Offal from industries.
(*f*.) Residues from the fabrication of extract of meat.
(*g*.) Diverse food; control of the feeding-stuffs.
B. Digestion and digestibility of food—General questions; Hay, straw, &c.; green fodder *v*. dry; fermented hay, steamed fodder; offals of the industries.
C. Preparation and conservation of the feeding-stuffs.
D. The different degrees of utilization of the food—animal food; inorganic food.

VIII. Animal production in its relation to food and external circumstances—

A. Increase and expenditure of constituents—
(*a*.) In general.
(*b*.) Respiration.
(*c*.) Expenditure of nitrogen.
(*d*.) Formation of fat.
B. Nourishment, diet, producing manure.
C. Rearing and keeping of animals—
(*a*.) Cattle.
(*b*.) Sheep—difference of breed, conversion of food.
(*c*.) Pigs.
(*d*.) Horses.
(*e*.) Goats.
(*f*.) Rabbits.
(*g*.) Silkworms.

D. Diseases of domesticated animals.

IX. Conception and breeding.

X. Technology—

Forestry; wine; distillery; beet-sugar; milk; cheese and butter; diverse.

XI. Analysis.

It may be seen from this list that not a single important question on agricultural chemistry has been left untouched by our stations, and that a tremendous quantity of work has been done. I will not deny that there is now a certain stagnation in the pursuit of researches in agricultural chemistry, but it is partly occasioned by most of the work being done as far as possible in the present state of organic chemistry, as I have already mentioned; and, on the other hand, the stations are employed more and more with analyses for the protection of the practical farmer, except those organised for a special purpose—for instance, dairy, brewery, distillery and other stations.

In how far the German system of agricultural experiments might be adapted to England I will leave to others to decide, but I think the English farmers will agree with me when I say that there might be done more than there is at present. A dozen stations distributed over the kingdom could effectively check the adulteration of fertilisers, feeding-stuffs, and seeds, and would, I think, be more efficient than the present system. What concerns purely experimental stations, according to my views, they ought to be few, but supplied with a sufficient apparatus for doing work on a large scale. Let one of them make acclimatization, another feeding experiments, a third experiments for the benefit of dairying, a fourth for brewing, and so on, then they will really do some good; only field experiments on crops and manures must be conducted at different places at the same time, if they are to have any other besides an only local value. I am sure if Germany can afford to spend £30,000 annually on its experimental stations, England might do something in the same line, and it is to be hoped that the good example given by the Highland and Agricultural Society of Scotland will be largely and liberally followed.

Statistics for 1876 *of the Industrial Institutions of the United States, which have received the National Endowment of Land-scrip under the Act of July* 2, 1862.

Location of the Institution.	Name of the Institution.	Number of Professors and Assistants in the Agricultural and Mechanical College for the collegiate year.	Number of Students in the Agricultural and Mechanical College for the collegiate year.	Annual Interest derived from the Scrip or Land granted by Congress—July 2, 1862.	Number of Acres contained in the Agricultural and Mechanical College Farm.	Value of the Agricultural and Mechanical College Farm.
				$		$
Auburn, Ala. ...	Agricultural and Mechanical College of Alabama.	7	104	16,224	100	2,000
Fayetteville, Ark. ...	Arkansas Industrial University ...	12	45	10,400	160	12,000
Berkeley, Cal ...	University of California, Colleges of Agriculture and Mechanics.	19	50	45,000	200	200,000
New Haven Conn. ...	Yale College, Sheffield Scientific School	31	230	8,100	No farm.	...
Newark, Del. ...	Delaware College	8	43	4,980	...	...
Eau Gallie, Fla. ...	Florida State Agricultural College ...	... *	...	6,068	...	...
Athens, Ga. ...	University of Georgia. — Georgia State College of Agriculture and the Mechanic Arts.	8	93	14,010	60	1,500†
Dahlonega, Ga. ...	University of Georgia. — North Georgia Agricultural College.	5	245	3,000	25	1,000
Urbana, Ill.	Illinois Industrial University ...	15	187	28,200	570	56,000
La Fayette, Ind. ...	Purdue University, Indiana Agricultural College.	8	1	20,314	159	47,700
Ames, Iowa	Iowa State Agricultural College ...	15	300	34,822	850	51,000
Manhattan, Kans. ...	Kansas State Agricultural College ...	16	303	20,491	255	25,000
Lesington, Ky. ...	Kentucky University, Agricultural and Mechanical College.	8	94	9,900	433	130,000
New Orleans, La. ...	Louisiana State Agricultural and Mechanical College.	6	209	13,734	600	40,000
Orono, Me.	Maine State College of Agriculture and the Mechanic Arts.	8	115	7,864	370	10,000
College Station, Md....	Maryland Agricultural College ...	6	77	6,900	285	14,200
Boston, Mass. ...	Massachusetts Institute of Technology.	36	293	4,011	...	...
Amherst, Mass. ...	Massachusetts Agricultural College ...	8	111	8,022	383	37,000
Lansing, Mich. ...	Michigan State Agricultural College...	13	166	16,880	676	47,320
Minneapolis, Minn.	University of Minnesota. — College of Agriculture. College of Mechanic Arts.	8	6	13,901	120	12,000
Oxford, Miss. ..	University of Mississippi, College of Agriculture and the Mechanic Arts.	6	15	5,679	100	2,000
Rodney, Miss. ...	Alcorn University, Agricultural and Mechanical College.	4	...	5,679	250	5,000
Columbia, Ms. ...	University of Missouri. — Agriculture and Mechanical College.	8	21	2,018	640	60,000
Rolla, Ms. ...	University of Missouri. — Missouri School of Mines and Metallurgy.	6	70	1,022	...	...
Lincoln, Nebr. ...	University of Nebraska, College of Agriculture.	5	13	None.	320	18,422
Hanover, N. H. ...	Dartmouth College, New Hampshire College of Agriculture and the Mechanic Arts.	11	24	4,800	365	21,000
New Brunswick, N. J.	Rutgers College, Scientific School ...	10	42	6,960	100	45,000
Ithaca, N. Y. ...	Cornell University. — College of Agriculture.	32	26	35,000	150	22,000
	Cornell University. — Sibley College of the Mechanic Arts.	21	58			
Chapel Hill, N. C. ...	University of North Carolina, College of Agriculture and the Mechanic Arts	9	61	7,500	Unknown.	...
Columbus, Ohio ...	Ohio Agricultural and Mechanical College.	11	140	30,000	320	200,000
Corvallis, Oreg ...	Corvalis College, State Agricultural College.	4	51	Unknown.	35	5,000
Centre Country, Pa ...	Pennsylvania State College	13	161	24,420	600	75,000
Providence, R. I. ...	Brown University, Agricultural and Mechanical Department.	13	35	6,624	No farm.	...
Orangeburgh, S. C. ...	Claffin University, South Carolina Agricultural College and Mechanics' Institute.	6	40	10,000	116	10,000
Knoxville, Tenn. ...	East Tennessee University, Tennessee Agricultural College.	12	58	23,760	260	24,000
Bryan, Tex.	Agricultural and Mechanical College of Texas.	6	50	12,000	2,200	20,000
Burlinton, Vt. ...	University of Vermont and State Agricultural College.	8	23	8,130	No farm.	...
Blacksburgh, Va. ...	Virginia Agricultural and Mechanical College.	10	255	20,639	250	28,000
Hampton, Va. ...	Hampton Normal and Agricultural Institute.	20	256	16,319	190	33,000
Morgantown, W. Va.	West Virginia University, Agricultural Department.	5	2	5,400	No farm.	...
Madison, Wis. ...	University of Wisconsin, College of Arts.	16	124	13,490	196	40,000
	Total ...	473	4,197	526,283	11,338	1,295,192

* This college has not been opened to students.

† Exclusive of the value of the college building, the original cost of which was $ 24,000.

JUTE IN THE UNITED STATES.*

It is a costly improvidence to pay other nations for staples and products which we can raise and manufacture as cheaply as they can. For all imported jute fabrics we are now paying the cost of production in India, the freight to England, the expense of manufacture, the transportation to the United States, and the commissions of all the factors and insurance-agents through whose hands the goods have passed. Millions of dollars are now annually paid to foreigners for labors that ought to be performed by Americans. We are heedless of the lessons of public economy. A diversity of employments and an industrial independence of other countries will most efficiently promote the welfare of our own people. It is the true policy of the United States to introduce and naturalize the industries of the Old World and to foster the commonwealth of the nation by paying to American handicraft the millions which are now the rich reward of European skill. The English Government finds it very difficult to introduce improved machinery or scientific methods into the agriculture of India. The inert masses resist innovation with a conservatism born of centuries of stagnation. The traditional implements and processes of an earlier age are still used in the tillage of India. The ploughs and harrows and the machines for spinning and weaving are of the rudest description. The natives are too poor to buy improved tools and too ignorant to use the better methods. They have not analized their soils, ascertained the best succession of crops, tested the different systems of fertilization or improved their primitive processes of preparing and manufacturing their staples. In fine, their labor is unintelligent, and therefore ineffective and unthrifty.

An industrial comparison of Southern States with India greatly encourages our hopes of success in this new industry. The labor of the South is far more intelligent than that of India, and it is constantly under skilful guidance. The Southern planters will not follow an antediluvian style of agriculture. In India the best soil is usually devoted to raising jute for the market and the poorer land is left for the production of jute-seed. The natural consequence of this course is the deterioration of the seed. In the United States, on the contrary, a portion of the best land has been reserved for seed, and the result is a signal improvement in the quality of the seed. American jute-seed is one-sixth heavier than that of India. The broadcast sowing of Bengal is uneven and wasteful. Our patent drills, saving 10 or 15 pounds of seed to the acre, do the work with far greater rapidity and equality of distribution. The efficiency of our agricultural machinery will more than neutralize the seeming advantage which India possesses in the cheapness of its manual labor. It would take tens or hundreds of Indian hands to do the work of one American machine.

It will be strange, indeed, if the mechanical ingenuity which in some departments of manufacture has triumphed over the cheap skilled labor of Europe, and enabled the United States profitably to export to the great centres of industrial art watches, cutlery, agricultural implements, coarse domestics, and some finer fabrics, cannot win a far greater victory over the unskilled hand labor of India.

* From the United States Agricultural Department Report.

POISONOUS GRAIN FROM GUZERAT.

On examination of the grain you sent me (known in Bengal as Kodoo and in this country as Varagu) I have not been able to discover anything in it to account for its poisonous effects.

A number of instances are recorded of the bad effects of this grain on man and cattle. It is understood that the grain raised at the proper season is wholesome, that that raised on the same ground as a second crop and that raised on wet marshy ground are both unwholesome.

Dr. Bonavia of Bengal is of opinion that the age of Kodoo has little to do with its poisonous qualities. He thinks that, after rain falls and the ear is ripening, a fungus attacks it, and it is this which is to blame. Washing the grain well before being cooked renders it harmless.

Dr. Macrae when acting Chemical Examiner at Madras, examined microscopically specimens of Varagu believed to be bad as well as good Varagu and reported that the one could not be distinguished from the other. On another occasion he made the following statement in regard to a sample of bad grain submitted to him for examination :—

"Placed in an air-tight glass chamber exposed to the influence of air and water some of the seeds germinated in three days, while a plentiful crop of what (microscopically) appeared to be ordinary mould was developed."

The poisonous grain is not a product of a variety but of the plant that yields the healthy grain.

Bad seed may produce wholesome grain.

(Signed) R. WILKINS, F.R.C.S.,
Lecturer on Botany in the
Madras School of Agriculture.

APPENDICES.

APPENDIX

TO THE

SAIDAPET EXPERIMENTAL FARM REPORT.

STATEMENT OF THE ACCOUNTS OF THE SAIDAPET EXPERIMENTAL FARM, 1878-79.

—	Receipts.	Expenditure.
	RS. A. P.	RS. A. P.
Fruits, vegetables, and fodder ...	939 9 1	...
Grains and seeds	217 9 10	733 7 7
Cotton and indigo	385 6 2	...
Live-stock, &c.	264 6 0	3,083 15 7
Rents, sundries, &c.	732 7 1	385 15 4
Manures	...	678 14 8
Implements and machines	...	1,345 2 8
Cooly labor	...	4,182 11 7
Establishment	...	1,585 10 4
Despatching seeds	...	185 14 7
Total ...	2,539 6 2	12,181 12 4

VALUATION OF THE SAIDAPET FARM AND ESTATE ON THE 31ST MARCH 1879, COMPARED WITH THAT MADE ON THE 31ST MARCH 1878.

—	Value of Stock on the 31st March 1878.	Increase in the Year.	Decrease in the Year.	Valuation of Stock on the 31st March 1879.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
ESTATE—				
Land	37,480 0 0	320 0 0	...	37,800 0 0
Buildings*	21,750 0 0	150 0 0	...	21,900 0 0
Wells and channels	7,000 0 0	...	...	7,000 0 0
Total ...	66,230 0 0	470 0 0	...	66,700 0 0
FARM—				
Live-stock.				
Cattle	2,650 0 0	...	990 0 0	1,660 0 0
Sheep	1,285 0 0	...	105 0 0	1,180 0 0
Pigs	...	140 0 0	...	140 0 0
Poultry	90 0 0	45 0 0	...	135 0 0
Dead-stock.				
Grains, &c.	614 0 0	422 0 0	...	1,036 0 0
Manures	310 0 0	...	85 0 0	225 0 0
Implements	6,426 0 0	...	188 0 0	6,238 0 0
Growing crops	920 0 0	...	140 0 0	780 0 0
Fruit and fuel trees	5,565 0 0	3,435 0 0	...	9,000 0 0
Total ...	17,860 0 0	4,042 0 0	1,508 0 0	20,394 0 0
Grand Total ...	84,090 0 0	4,512 0 0	1,508 0 0	87,094 0 0

* Does not include any buildings, but those belonging strictly to the Farm.

APPENDIX

TO

THE GENERAL REPORT.

STATEMENT OF THE ACCOUNTS OF THE MADRAS AGRICULTURAL DEPARTMENT.

Expenditure.

I. General Supervision—	RS.	A.	P.	RS.	A.	P.		
Establishment	19,382	10	6					
Travelling allowance	630	11	6					
Contingencies	579	4	3					
Ploughing match	189	14	0	20,782	8	3		
II. Saidapet Experimental Farm as detailed in the Appendix ...	...			12,181	12	4		
III. Implement Workshops as per statement given in para. 117. of the Report	...			1,730	0	4		
IV. Educational (School of Agriculture) as per statement given in para. 44 of the Report	...			16,170	0	7		
V. Estate Improvements—								
Repairs and alterations to buildings	1,166	10	10					
Trees and planting	245	12	4					
Manufacture of drain pipes and subsoil drainage	241	5	0					
Brick and morter bridges under main roads	97	1	2					
Contingencies	139	8	3					
Fence around Roshumbaug Village	151	0	8					
Reroofing western sheep house and building a tool house ...	301	8	9					
Extension to water channels	601	12	7					
Remaking a portion of new road from the Tamarind Tope, north, and the Mount Road	369	4	0					
Sundry work and alterations	384	9	0					
Reroofing old cattle shed and converting it into a sheep shed	361	2	3					
2 wells	201	10	10	4,261	5	8		
VI. Other charges not paid through the department—								
Allowance to Surgeon paid by the Saidapet Treasury Deputy Collector	...			848	11	4		
Expenditure incurred by the Public Works Department—								
Constructing Laboratory for the School of Agriculture ...	5,449	4	0					
Providing a temporary building for the accommodation of School of Agriculture	1,550	0	0					
Clearing the Chembrumbaukum Channel to the Farm ...	482	2	0	7,481	6	0		
Paid value of books by transfer	48	0	0					
Paid value of books supplied by the Director of Public Instruction by transfer	166	11	8	214	11	8		
Paid Public Works Workshops for 1 casting bell by transfer	86	0	0					
Paid Public Works Workshops for 2 seals by transfer ...	5	8	0	91	8	0		
				63,762	0	2		

Income.

Adjusted balance at the beginning of the year	1,91,215	13	7					
Provincial Grant	20,000	0	0					
Receipts from the Surplus Pound Fund during the year 1878-79—	61,825	1	9					
Saidapet Experimental Farm as per statement given in the Appendix	2,539	6	2					
Implement Workshop	1,720	14	7	2,77,301	4	1		
Balance in favor of the Department on the 1st of April 1879 ...	...			* 2,13,539	3	11		

(Signed) C. BENSON, M.R.A.C.,
Acting Supt. of Govt. Farms, Madras.

SAIDAPET,
29*th May* 1879.

* This is approximate only; see note, page 136.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ THE FOLLOWING PAPERS :—

Proceedings of the Board of Revenue, dated 28th July 1879, No. 2,131.

Read the following letter from C. BENSON, Esq., M.R.A.C., *Acting Superintendent, Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Saidapet, 16th July* 1879, *No.* 812 :—

I HAVE the honor to forward herewith two copies of the Saidapet Farm Report for the official year 1878-79. The complete report will, I hope, be submitted ere long, but the matter altogether rests with the printer.

IN his letter, No. 812, dated 16th instant, the Acting Superintendent of Government Farms submits his Assistant's report on the Saidapet Experimental Farm for 1878-79, which will be forwarded for the information of Government. It is noted that Mr. Benson hopes that the complete report will be submitted ere long.

2. The year was not favorable for the farm, the total rainfall registered being only 33 inches—about 18 inches less than the average of the previous ten years. The rain, too, was badly distributed, more than half of it falling unseasonably; the consequence was that the growth of plants was checked in October when rust set in and destroyed one crop of cholum entirely.

From various experiments made it was found that sowing cholum in line at distances 9 inches apart produced better crops than any other description of sowing.

3. The Madagascar paddy was a failure in point of yield, and is costly to raise as it takes long to mature.

4. Some experiments were made with tobacco. Lunka and Madura tobacco grew well, as did also an Italian variety, but the most successful was the Maryland tobacco, which yielded the largest return and finest leaf. The attempt at curing, however, seems to have been a partial failure, and the Acting Superintendent should report on the quality of the tobacco thus dried.

5. Altogether crops were raised on 214 acres, but some of these were grazed down by cattle, and it has not been possible to record the outturn. Some experiments were made in deep ploughing and in the treatment of sugar-cane and cotton with various kinds of manure. The cattle in the yard did well and were maintained at a cost about 40 per cent. higher than in the previous year.

6. The Swedish plough for heavy work and the American plough for light ploughing were in use during the year; two Collins' ploughs sent to the farm for trial did not work satisfactorily, but they are capable of some improvement.

7. A chaff-cutter made on the farm at a cost of Rupees 36 is capable of cutting up 790 lbs. of fodder at a cost of 6 annas per diem.

8. The double mhote lift is said to continue to give the most favorable results and may possibly be still further improved by the substitution of leather for the ordinary ropes now in use.

9. A small piece of land on the river bank was added to the estate, and a large number of casuarinas were put out with castor plants between; the season was however unfavorable and the castor plants were destroyed by drought before they afforded shade.

(A true Copy and Extract.)

(Signed) J. STURROCK,
Acting Sub-Secretary.

Proceedings of the Board of Revenue, dated 28th August 1879, No. 2,475.

Read the following letter from C. BENSON, Esq., M.R.A.C., *Acting Superintendent of Government Farms, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Saidapet, 2nd August* 1879, *No.* 959 :—

I HAVE the honor to submit herewith the annual report of this department for the year 1878-79. The report on the School of Agriculture was forwarded to Government on the 25th of June 1879, through the Director of Public Instruction, as in previous years; and my report on my tour in Trichinopoly has already been submitted to the Board.

2. The instructions regarding the omission of all papers of general interest from the report were not received until the selections for this year were in the Press, but a large number of interesting extracts from our correspondence which I had made have been omitted.

THE publication of this bulky volume was quite unnecessary, almost all the matter having already appeared elsewhere. Under G.O., dated 16th June 1879, No. 1,286, and G.O., dated 23rd June 1879, No. 1,325, the Saidapet Farm report, the Agricultural School report, and reports on miscellaneous agricultural operations conducted by the Superintendent, are each to be separately submitted as occasion demands. The tour reports also are necessarily submitted separately. The matter, if any, which remains for a report on "Government Farms" generally need not occupy more than a page or two. The present volume having been printed will now be submitted to Government.

2. The Board take the opportunity to remark that the reports issued by the Superintendent might in all cases be condensed with advantage. The same amount of information could be given in a much briefer space. The Board are aware that the growth of the reports has been gradual and that there is nothing special in the size of the reports this year. But the matter demands the Superintendent's attention.

3. Referring to G.O., dated 16th June 1879, No. 1,286, the Superintendent should submit to the Board copy of his report on the Agricultural School, at the same time that he forwards the original to the Director.

(A true Copy and Extract.)

(Signed) C. D. MACLEAN,
Acting Sub-Secretary.

ORDER THEREON, 9th October 1879, No. 2,035.

WITH the earlier of the foregoing Proceedings the Board of Revenue forward the Acting Superintendent's report on the operations on the Saidapet Farm in 1878-79. This report was sent to the Board on the 16th July, but in an incomplete state as the financial, &c., statements were not appended but were attached to the volume submitted with the Board's later Proceedings. This volume contains the

report on the School of Agriculture and on Mr. Benson's tour in Trichinopoly; and as the former has already been disposed of by Government and the latter is still under consideration, neither should be distributed with the Farm report, which has its distinct use and distribution list, and should, as already ordered, be separately submitted.

2. The success of the operations on the Farm was affected by a somewhat abnormal season. The crops suffered from fungoid diseases and rats, and it is suggested that the increase in the numbers of the latter may be due to the too great destruction of snakes.

The outturn of the crops generally was not good, but experience was gained respecting the value of, and drawbacks to, deep ploughing.

3. The Government notice that in the full and interesting account of the experiments made in growing and curing different kinds of tobacco, nothing is said of their market-value. This should be at once ascertained and samples analysed. Further experience is also required to test the belief (paragraphs 79 and 83) that "when tobacco is grown during the cold season irrigation may be entirely dispensed with."

4. Paragraphs 22—27 review the results of the subsoil drainage experiments of 1875. Owing to the nature and lay of the land the work was attended with difficulty and, from the inexperience of the workmen, indifferently executed; a striking improvement was, however, found in the physical condition of the soil. The drains have now been relaid with greater care and success at a cost of about Rupees 20 an acre, and it only remains to compare the future yield of the land and thus put the value of the operation to a practical test.

5. *Financial Results.*—In the absence of all details as to the manner in which the estimate is arrived at, no opinion of the accuracy of the value of the estate and dead stock, which is estimated to have materially increased during the year, can be formed. This information should be at once supplied. The Government presume that the prescribed forms of accounts are now in use and that a more instructive financial statement will accompany the next report.

6. A serious falling off is again reported* in the value of the Farm cattle, and explanation must be afforded. The illness and death of the Australian cows is shown by Mr. Western to have been in all probability due to preventible causes, and his remarks must be borne in mind in the treatment of any foreign cattle that may hereafter be bought.

	Value.	Decrease.
	Rs.	Rs.
*1877-78	3,980	1,330
1878-79	2,650	990

(True Extract.)

(Signed) J. H. GARSTIN,
Acting Secretary to Government.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 10th October 1881.

No. 1,935.

Read—the following Proceedings of the Madras Government, Revenue Department, dated 18th May 1881, No. 785.

Read—the following Proceedings of the Board of Revenue, dated 10th February 1881, No. 227.

Read the following letter from C. BENSON, Esq., M.R.A.C., Acting Superintendent of Government Farms, Madras, to the Secretary to the Board of Revenue, dated Bellary, 12th August 1880, No. 74.

I HAVE the honor to submit the Annual Report on the work of this department for the year ending 31st March 1880. The report was forwarded to the Press on day of the date which it bears, and, though much shorter, has taken longer to print than last year's report; it would also have been sent to the Press considerably earlier had not considerable delays occurred in compiling the tables given in the appendices.

ENCLOSURE No. 1.

The Annual Report of the Superintendent of Government Farms for the Year ending 31st March 1880.

INTRODUCTORY.

THE season of the past year was very favorable generally to agricultural operations, and was one marked by revived energy in farming pursuits. No extension of the work of this department, however, took place, and its scope remains the same as it was three years ago. * * *

2. As considerable misunderstandings as to the nature of the duties of this department frequently arise, it will perhaps not be out of place for me to give a short summary of them. They mainly consist of the following branches:—

(1.) The direct management of agricultural education.
(2.) The inspection of tracts of country and the preparation of reports on their agricultural conditions and capabilities.
(3.) Conducting the farming operations of the Saidápet Farm, and of such other farms as may be established.
(4.) The introduction and distribution of seeds, &c., likely to be of value in the Presidency.
(5.) The management of Agricultural Exhibitions, &c.
(6.) The preparation of agricultural text-books, reports, pamphlets, &c.
(7.) Answering references on agricultural matters from Government, the Board of Revenue, Government Officers, and the Public.

To these may be added efforts for the prevention of disease among live-stock, the salary of the Inspector of Cattle Diseases having, when the office has been filled up, been met from the funds allotted to the work of the department. There are other duties also which should properly belong to the department, and amongst these may be mentioned the collection and scrutiny of agricultural statistics. * * *

* * * * *

AGRICULTURAL EDUCATION.

5. This is now by far the most important division of our work; in fact, so nearly has our work become purely educational that the anomaly of its being separated from other branches education has been brought to the notice of Government.

School of Agriculture.

6. Regarding the School of Agriculture a separate detailed report has been submitted, which is not, as heretofore, to be published with our annual volume. No very important changes in its working were made during the year except that the date for admitting students will in future be April 1st instead of September 1st. The system of paying lecturers by fees

is still adhered to, but, from its expense and its comparative inefficiency, must ere long be given up if the institution, which has now become a permanent one, is to be placed on a footing of thorough efficiency.

No passed students employed by the Madras Government.

7. In June last our first class of students completed their course of training and twenty-four received certificates of having passed the examinations of the institution successfully. * * *

* * * * *

9. With a view to offer some inducement to young men to study agriculture, I suggested, as had been proposed before by Mr. Robertson, that our certificate should form a special recommendation for employment in the Revenue branch of the public service, but on this point the Board of Revenue observed that —

"Such a course would give undue support to an agricultural education to the disadvantage of other means of entering the Government service. Furthermore, it would not be calculated to benefit the agriculture of the country, for young men, who had gone through this course only for the purpose of entering Government employ, would be likely to cast the subject aside as soon as their end was attained, and they would have no leisure to practically instruct so as to influence the cultivators about them, and from want of use must shortly forget what they had learnt."

* * * * *

The suggestion did not meet with the approval of Government. * * *

Encouragement of honorary distinctions.

10. Another means of inducing the study of any particular subject is the grant of honorary distinctions, such as degrees, to those who take it up. From its importance, agriculture in this country should not be left without aid of this kind; such is granted to Medicine, Civil Engineering, and General Education; and, perhaps, if Government are not willing to devote a small sum of money towards the encouragement of the study of a profession which has so much to recommend it, some course might be devised to throw open distinctions in agriculture, as in Civil Engineering, to students of the subject. But even such inducements would, it is to be expected, not act so powerfully in the case of agriculture as in that of other professions. And regarding this subject, I may quote Professor J. Wilson, Professor of Agriculture in the University of Edinburgh:—

"Even the inducements of honorary distinctions, and of direct money prizes, seem to operate differently on them than on other branches of the community. The diplomas and certificates of Highland Society are awarded to deserving candidates free of any cost, and carry with the life Membership of the Society; while the bursaries so liberally offered each year by the Society—viz., ten of £20 each and five of £10 each—have never yet succeeded in inducing even half that number of candidates to compete for them. This year, 1879, I am informed there are only four names entered, while there are fifteen bursaries offered for competitive examination."

* * * * *

12. Every effort to get together a sufficient number of students to form a fresh class of students in September last failed. The causes of this failure are discussed in the report on the working of the College, but the chief cause no doubt was the sudden reduction of the pecuniary inducements to students.

Model farms as an educational means.

13. Early in the year it was proposed by the Board of Revenue that a portion of the Saidápet Farm should be set apart for the purposes of carrying on a commercial farm, as they held "that a well-devised system of Agricultural instruction must necessarily embrace a demonstrative comparison of profits" between native and improved farming, and in this view the Government concurred and directed me to suggest how the purpose could be attained in connection with the School of Agriculture. In reporting on the matter I stated that there was no suitable site for the purpose on the Saidápet Farm, and at the same time pointed out several misconceptions which surrounded the subject. I showed that as an educational means the comparison of profits had not of late years been considered a necessity in England, Germany, or America, where at first model farms were almost always looked upon as necessary adjuncts to Agricultural Colleges, and I remarked that the assimilation of portions of our practice must be left to students themselves, and pointed out that our object was simply to demonstrate those principles of agriculture which hold good under all conditions. I also stated that I thought it as yet greatly premature to venture to attempt to set before the native farmers a "Model Farm," that is, a farm, the whole system and practice of which we definitely advise them to adopt. At the same time I expressed my belief that there is little hope of the effects of the force of example influencing the present race of ryots; but that, as the Board had themselves remarked, we can "expect much from the establishment of Educational and Experimental Farms in some of the districts," and that "the main effect to be looked for from such farms

Premature to attempt.

Small effect of example.

should not be the impressions made on the adult agriculturist by a few successful examples;" the agricultural community generally in this Presidency at least not being in a position to apply and profit by the lessons to be learnt from the operations of the Model and Experimental Farms to any appreciable extent, save by slow degrees.

Best method of testing system.

14. I showed that in our reports we frequently show the actual charges on and returns from different fields and crops, and this is, I believe, the best method of testing the advantage the system would be to the ryot, whilst it is admitted that under the systems we are carrying out there is a greater certainty of crop, and therefore greater benefit to the State. I also stated that I doubted whether, if our accounts of a commercial farm were published, they would carry conviction to the minds of any native farmers, for I believe that they would always be cavilled at, as accounts such as those referred to above have been, and I pointed out that the peculiar circumstances of a Government Farm, which require a large expenditure on "appearances,"

Commercial position of a Government Farm.

where all things are bought at a premium and sold at a discount, where it is impossible to obtain full labor from coolies, and many other things, all militate severaly against its "commercial" success. On this last observation Government remarked that there was no reason for such a state of things, but I believe that it is a universal experience; and is especially caused by the high price of labor, when coolies are not working for themselves or for persons of their own color. I may also add that very frequently the crops raised by the ryot are grown at what would be a loss if his pay were calculated at rates such as must be paid by Government. The proposal was given up.

Efforts for the dissemination of agricultural knowledge in the mofussil.

15. In September 1871 Government expressed the opinion that the time had then come when they might, with confidence and advantage, extend their operations over a wider field and afford to the agricultural interests of this Presidency the benefits and aids of the teachings of scientific agriculture, and it was resolved to start experimental farms of considerable area in various districts. Up to the present time this scheme has in no particular been set on foot, "partly," as Government observe, "in consequence of unexpected difficulties in obtaining land of sufficient area in suitable places, and partly because it has proved impossible to find as yet among the natives of the country persons who are qualified to undertake the management." * * *

Urgent necessity for doing something in this direction.

16. If it be incumbent on Government to provide agricultural education in this country, and this is now generally admitted, it is particularly necessary to furnish it in an elementary form in the districts, where there is some chance of reaching the rural population. This has been impossible till recently owing to the absence of educated teachers; but, now that we have a system which is capable of turning out competent teachers, it should, I submit, be the object of Government to establish elementary agricultural education rather than, unless both can be conducted simultaneously, to push forward higher education of the nature we are giving in the School of Agriculture here, and to endeavor to benefit the greatest number possible, if only in a small degree, and thereby recoup the heavy expenditure incurred in training the students here; whilst at the same time some of the funds contributed by the different districts to our work would be expended in them for their benefit. The chief aim of Government should therefore now be, I submit, to provide every district in the Presidency with an agricultural class in its chief school as fast as competent teachers become available; and attention to the subject of agriculture should be drawn by offering prizes to those who show proficiency in it in the schools, and this might be especially done by means of scholarships to enable successful students to proceed to the School of Agriculture to increase their stock of knowledge, and by making agriculture a test for entrance into the Revenue Department.

Partial adoption of a scheme to meet the want.

17. Shortly before the close of the year Government decided to adopt a suggestion of the Board of Revenue, made in reviewing a scheme submitted in order to attain the ends mentioned in the preceding paragraph to start agricultural classes in three mofussil schools "experimentally;" * * * . The scheme for working these classes has yet to be developed; but, it is not necessary for me to show, how utterly inadequate to the wants of the country must the location of three isolated classes in the mofussil prove.

18. The only step in advance which was made during the year in this branch of our work was the recognition of the value of agricultural education shown in the new Educational Grant-in-Aid Code, whereby our certificate-holders will be qualified for earning salary grants for teaching agriculture.

AGRICULTURAL TOURS.

Tour in Cuddapah and North Arcot.

19. The only tour made during the year by any officer of the department was one I proceeded on in the month of August in the Cuddapah and North Arcot Districts, for which I left my head-quarters here on August 2nd, returning again on September 1st, so as to be on

the spot at the time of the reopening of the School of Agriculture for the Winter Session. Owing to the short time at my disposal, I was not able to see nearly the whole of the districts named, and visited only the following taluks and places in them :—

Taluks.	Places visited.
Cuddapah	Cuddapah, Kázipet, and Kamalapuram.
Jammalamadugu	Muddanúr, Jammalamadugu, and Kondápuram.
Ráyachóti	Ráyachóti.
Váyalpád	Gurramkonda.
Madanapalle	Madanapalle.
Palmanér	Palmanér.
Gudiyátam	Gudiyátam.

The places named were the centres from which I inspected the localities in their neighbourhood.

20. My report was completed by September 20th, and submitted through the Collector of Cuddapah in a printed form before the end of October, but had not reached* the Board by the 1st of April. The tour was a very hurried one, as I had only a month at my disposal for the work, my presence being necessary at Saidápet as soon as the School of Agriculture reopened, and I was unable to leave Saidápet earlier owing to there being no other officer on the spot to take charge of the farm. From the nature of the tour I was unable to collect sufficient information to enable me to discuss the agricultural condition of the district, and confined myself to notes on what I saw and learnt of the farming operations of the ryots; it was a matter of regret to me that I was unable to do more, for I do not consider that Government derived full benefit from such a tour of inquiry when the scope of my observations was so limited.

Hurried nature of the tour.

21. The necessity for officers of this department making a detailed study of the agriculture and agricultural condition of the Presidency has often been urged, and a small commencement has been made in Mr. Robertson's Coimbatore tour and mine in Trichinopoly, besides that in Cuddapah referred to above. It is, however, plainly evident that, unless the work be more strenuously undertaken, but little progress can be made. Now that the School of Agriculture is in full work, the Superintendent of Government Farms, being in charge of it, will be unable to proceed on tour excepting during the vacation—July and August—and even then the time at his disposal is short, and his absence from head-quarters will not always be possible. The time of a special officer working something on the system of the Geological Survey Officers would be valuably employed in such work.

Necessity for studying native farming.

* * * * *

THE SAIDAPET EXPERIMENTAL FARM.

23. The Board of Revenue having sanctioned the publication of the results obtained in the working of this farm in a more convenient form than the annual report, as a portion of a volume of "Records," it is not necessary for me to do more than briefly summarize the proceedings of the year, matters of permanent interest finding their place in the records; at present, however, the amount of matter available is so small that it is improbable that a volume will be issued for some time.

Introductory.

24. *The Season* of the year under report was on the whole favorable for the farm; the total rainfall registered was 56·95 inches falling in 82 days; the average of the previous 10 years having been 50·74 inches collected in 64·3 days; the excess was chiefly due to very unusual rains which fell during January and February last. The rainfall was tolerably well distributed except that on few occasions a great amount fell in a very short time, which did great damage to standing crops and to the fields by washing the surface, but was of little value as most of it ran off the surface as soon as it fell, and also that in September there was a great deficiency.

General character of the season.

25. No rain fell in April: a severe storm burst on the locality on the 21st May, during which 3·9 inches of rain fell; the total amount of rain that fell in this month being only 3·99 inches. The storm, which was more notable for the force of the wind than for the amount of rain that fell, prostrated nearly all the plantain trees, carried away bodily the roof of one of the sheds, and otherwise did considerable damage. Owing to the forward state of preparation in which the land was, as explained in last year's report, the rain was readily absorbed and, the surface of the fields being very generally broken up, moistened the ground to such an extent as to admit of a considerable area being put down under hot-weather crops: these were chiefly gingelly and horse-gram sown at the end of May. In June 1·8 inches of rain was registered; all of which fell in gentle showers on eleven days; and was thus of great value, and the month was very

* It was forwarded to Government with Board's Proceedings, No. 545, dated 22nd April 1880.

favorable for the growth of the crops sown in May. The gingelly and horse-gram crops looked so remarkably well at the end of June as to justify the expectation of an unusually good summer harvest.

Unfavorable weather in July.

26. The month of July, however, was most unfavorable for the hot-weather crops; the first half of the month was very dry, and the crops that had grown very rapidly under the favorable conditions experienced in June were not hardy enough to accommodate themselves to the abrupt change of conditions; especially the gingelly, which suffered so much during the early part of the month that before the middle of it it had commenced to flower, and soon shrivelled up and consequently produced but little seed. The latter portion of July was more favorable for ploughing, &c., but the rain that fell at that time was too late to be of any use to the gingelly crop; the total amount of rain registered during the month was 1·33 inches.

Season favorable in August.

27. The weather in August was everything that could be wished for preparing the land for cold-weather crops; the exceedingly large amount of rain—7·24 inches—which fell during this month was distributed over fifteen wet days, but was nearly all precipitated during the latter half of the month. The weather continued to be very favorable for the preparation of the land and for sowing cold-weather crops during the first part of September, and with the early-sown crops of cotton, maize, cholum, and Sorghum, put down at the commencement of the month, being placed under very favorable conditions, the seed germinated freely and the plants made great progress during the first stage of their growth. But the bright dry weather predominating during September, which had very beneficial effects on the crops during the early part of the month when there was sufficient moisture in the ground, had a contrary effect after the middle of the month, when the soil had again dried and at the end of it the crops suffered so much that, if the dry weather had continued some days longer, the cholum crops would have perished. The cold-weather crops thus experienced the same conditions as those grown in the hot weather; very favorable weather immediately after sowing, which caused a very rapid growth, making the plants unfit to withstand the effects of the dry weather which followed, and, had it not been for the opportune rain which fell at the commencement of October, nothing would have saved them from a similar fate; the cholum would have been lost as the gingelly was. As it was, the maize sown in one of the rotation fields was induced by the great heat and want of moisture to flower when not half developed and had to be cut down at that time. On the whole, the dry weather in September was the cause of considerable loss to the farm as it prevented the sowing of a large area of land, which in ordinary seasons would have been got under a crop, and thus at the end of the month the work of the farm was in a backward state.

Result of a dry September.

Favorable season in October for growing crops.

28. The month of October was very favorable for the growth of the standing crops; the cholum crops, which had suffered severely during September, revived after the rain that fell at the commencement of October. The total amount that fell in October was 19·13 on seventeen rainy days; about 10 inches of this falling during seven rainy days between the 2nd and 11th and the remaining 9 inches between the 18th and 31st. Although there were only seven rainless days between the two rainy periods, yet on the 18th of October the more sandy soils had become quite dry and the crops growing on them had begun to suffer from want of moisture and the heat; this shows that the evaporation must have been great at that time. Undoubtedly the evaporation was chiefly due to the closeness of surface and the crust on the soil caused by the preceding heavy rain. The almost continuously wet weather during the latter portion of the month kept back sowing operations considerably. The months of November and December continued to be favorable; 11·87 inches of rain fell during November and 5·51 inches during December. A very heavy shower of rain fell on the morning of 23rd December; the shower lasted only about a quarter of an hour, but during this short time such an amount of water was precipitated that some drains overflowed which had never been seen to run full before. November is the month in which the indigo crop is usually put down, but partly owing to the nature of the season, and especially from the comparatively dry weather which prevailed from November 20th till December 23rd, the sowings made were not generally successful, and a much smaller area than had been intended was sown with this crop.

Peculiarity of season allowed late sowing of cold-weather crops.

29. The very favorable weather of December was utilized to put down a large area of crop towards the end of the month and early in January: gram and gingelly were chiefly sown at this time. There being sufficient moisture in the soil, the seed germinated very well but the plants were soon checked in their growth by the crust of the surface soil caused by intense evaporation. To break the crust the harrow was used with very satisfactory results. The land was generally harrowed across the lines of the crop when it was from one to six inches high. In some instances rain fell immediately after sowing and it caused crusting of the surface soil to such an extent that the germs could not break through; the harrowing, however, broke up the crust and pulverized the surface: sometimes the harrowing was repeated at intervals of a few days, when the soil had become consolidated, by this means the soil was kept in a friable state and a portion of the weeds that sprang

up were eradicated; few plants were damaged by the harrow, and the crops thus treated showed indubitable signs of improvement immediately after harrowing. Some of the crops received no other interculture besides harrowing, especially those sown in close lines.

30. The weather during January was most favorable; being dry during the greater part of the month it admitted of harvesting the early-sown cold-weather crops that had by that time ripened. The 2·3 inches of rain that fell during the latter portion of the month were sufficient to maintain the growth of the crops then on the ground, and the rain—2·5 inches—that fell in February revived those that had commenced to suffer and supplied the soil with sufficient moisture to bring the late-sown crops to maturity. No rain fell in March.

Season very favorable for fodder crops.

31. The peculiarities of the season were on the whole more conducive to the growth of forage than of grain crops. This year so much fodder was raised that at the close of it so large a quantity was on hand that there was scarcely room enough to store it, and the farm-yard now presents an appearance which has probably not been witnessed before. In some of the fields, however, the yield of grain was more than that obtained in previous years; this was the case with the early-sown crops, the late-sown crops not having produced much grain. The cotton, which had on account of the favorable season been sown very early, did not begin to bear until very late, the season having been too wet to promote the production of lint; and the indigo crop was on the whole unsuccessful. The Mylapore Tank-water was this year available until the end of March and, if the calingulah were not so very low, the water would have lasted a month longer. By means of the tank-water some very good crops of paddy were raised at a small cost and in some fields a second crop was obtained. If the calingulah of the tank were raised, the area of paddy land could be advantageously extended. Some of the land which has been laid away under Guinea grass for the purpose of raising fodder and forming grazing ground for the breeding stock, which were to have been kept when the Commissariat slaughter-yards had been removed, could have been profitably cultivated with paddy had it been free for the purpose.

32. Below is given a table showing the rainfall registrations throughout the year, and in Appendix I statements are given showing the weekly and monthly rainfall compared with that of previous years:—

Date.	April 1879.	May ,,	June ,,	July ,,	August ,,	September ,,	October ,,	November ,,	December ,,	January 1880.	February ,,	March, ,,
1	..	..	..	..	..	0·07	..	0·08	..	..	..	..
2	..	..	..	..	..	..	1·40	0·07	..	..	..	..
3	..	..	·15	..	·15	..	..	0·28	..	..	..	..
4	..	..	·02	..	·08	..	5·85	..	0·82	..	..	..
5	..	..	·01	·05	..	..	0·25	0·06	0·44	..	..	..
6	..	..	..	..	..	..	0·02	..	..	..	..	..
7	..	..	·40	·02	..	0·20	..	2·20	..	..	..	..
8	..	..	..	..	·02	0·50	2·09	0·40	..	..	..	..
9	..	..	·50	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	0·16	..	..	..	..	..
11	..	..	..	..	..	0·50	0·38	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	2·45	..	..	..	..
15	..	..	..	·07	1·25	..	..	1·83	..	..	..	..
16	..	..	·05	..	0·45	..	..	..	0·06	..	..	..
17	..	..	..	·38	..	..	..	..	..	..	..	..
18	..	..	..	·08	0·62	..	..	0·50	0·35	..	2·50	..
19	..	..	..	..	0·45	..	0·30	3·30	0·04	..	..	..
20	..	..	·04	..	0·02	..	1·10	..	..	..	..	..
21	..	..	3·90	..	..	..	0·55	..	..	0·45	..	..
22	..	..	·05	..	..	..	1·90	..	..	..	..	..
23	..	..	..	·07	0·05	..	0·10	..	3·70	..	..	..
24	..	..	·15	..	0·22	..	1·60	..	0·10	..	..	..
25	..	..	·13	·05	..	..	0·08	..	..	..	..	..
26	..	..	·07	..	0·06	..	..	..	..	..	..	..
27	..	..	·05	..	0·30	..	..	..	..	..	..	..
28	..	..	..	..	0·75	..	..	..	..	..	..	..
29	..	..	..	·10	1·42	..	0·45	0·70	..	..	..	..
30	..	..	·28	·15	1·40	..	1·85	..	..	0·30	..	..
31	..	..	..	·36	..	..	1·05	..	..	1·55	..	..
Total ..	..	3·99	1·81	1·33	7·24	1·27	19·13	11·87	5·51	2·30	2·50	..

Failure of experiment explained.

33. *Drainage.*—The piece of land drained in the year 1875 and redrained last year gave satisfactory results at first, but during the heavy rains the water in the nullah, into which the drainage water is discharged, rose several times some feet above the outlet for several days. The flood-water entering the drainage pipes stopped their action, and water was repeatedly

observed standing nearly immediately over the pipes for several days after heavy rain. Soon after the first heavy rains in October, it was observed that the pipes discharged but little water, which flow after subsequent rains ceased entirely, although the water in the deposit cisterns had risen nearly to the level of the surface of the land, clearly indicating that the drainage was out of order. The stoppage was most probably caused by the backwater checking the current of the drainage water in the pipes and thus causing the deposit of silt previously kept in suspension as long as the water was in movement. In this case the experiment has not proved successful as an example of subsoil drainage, owing chiefly, if not solely, to the want of a proper outlet which in draining land should always be at a sufficiently high level to prevent any stoppage of the flow of the drainage water during any part of the year. I do not consider that it is worth while to go to further expense on this land, but during the current year another plot of land, situated under more favorable conditions, will be subsoil drained. But, although the drainage did not entirely fulfil the object for the sake of which it was undertaken, there can be no doubt that the piece of land has been greatly improved by the drainage. On a portion of it, which never previously produced a fair crop, this year a very fine crop of gram was grown and a much better one than on the remaining part of the field.

34. *The Rotations* of crops commenced in the year 1877-78, and referred to in paragraphs 16 and 17 of that year's report, were adhered to. The outturn of cotton from Field No. 3, referred to in paragraph 20 of last year's report, was at the rate of 318 lb. of seed-cotton per acre, which, considering the very low manural condition and the bad physical state of the soil, is fair; the plants flowered profusely, but being very small did not yield heavily. The crop was allowed to stand until August, and the land was then ploughed thrice and once subsoiled during the months of September and October and lime was applied at the end of October at the rate of 3,000 lb. per acre. The land was sown with indigo at the commencement of November, but unfortunately the seed available was not good and the season at the time of sowing unpropitious so that several resowings were rendered necessary; but the last sowing was tolerably successful, and the crop has since done fairly; the first cutting was obtained on the 12th and 14th of April, when seventy-five bundles, weighing 6,644 lb., of indigo plant were obtained. The small outturn was due to the lateness of the sowing; there was a sufficient number of plants on the ground, but they neither grew high nor spread much.

35. The second rotation field, No. 16, was sown with maize and cotton at the commencement of September, it having been manured with box manure at the rate of eight tons per acre. The maize was a failure; the seed germinated tolerably well, but, owing to the unusual weather experienced in September referred to above, the plants commenced flowering when only about two feet high and were then removed. The cotton germinated well and grew very well at first, but its growth was soon checked by the intense heat. The plants suffered severely from the injury done to their leaves, which became covered with red spots, owing either to destruction of their tissues under the influences of the weather or to a fungoid disease; they, however, soon recovered, but began to bear very late. The outturn of lint nevertheless promises to be fair, the details of which will be given in next year's report.

CROPS.

36. Appendix II of this report contains statements regarding crops harvested during the past year:—

Statement A, referring to Food-grains.
Do. B, do. to Industrial crops.
Do. C, do. to Fodder crops.

Below remarks are made which will suffice to show the general results, and any points of abiding interest will be recorded in the volume of records already alluded to.

37. At the commencement of the year the extent of cultivable land on the farm available for arable purposes was 142·04 acres; but of this 27·22 acres were laid down in grass for pasturage and remained so during the year; on the remaining area 37·23 acres of crop were standing on April 1st, 1879; including this the following areas of crop were raised during the year, the figures given showing the state of affairs on 31st March 1880:—

—	Ploughed in green.	Harvested.	Standing.
	ACRES.	ACRES.	ACRES.
First crop	21·80	80·71	12·31
Second crop	20·80	59·41	12·06
Third do.	3·54	26·30	15·37
Fourth do.	..	9·18	..
Fifth do.	..	3·54	..
Total ..	46·14	179·14	39·74

38. The area of crop raised during the year was thus 227·79 acres; the outturn from some of these was not recorded from various causes, *e.g.*, being grazed down, or used as manure. Twelve pairs of cattle were maintained to perform the work of cultivation, or one pair for each nineteen acres of crop raised; these cattle also performed a good deal of work on the Guinea grass, &c., kept as pasture, and supplied labor for the Botanical grounds, and to a certain extent for such estate works as were in hand.

39. *Food-grains* were raised on a comparatively small area, and may be subdivided into the following three classes—

Unirrigated cereals,
Irrigated cereals,
Unirrigated pulses,

each of which is separately referred to below.

40. *The area of unirrigated cereal crops* raised during the year was small owing to circumstances already detailed. The outturn from the summer crops of cumboo was very low, and confirms the opinion that they are seldom profitable to raise in this locality; the total area, 10·36 acres, yielded an average of 134 lb. grain and 3,560 lb. straw per acre; the supply of fodder, however, was very useful and allowed of the use of a good deal of horse-gram as green manure. With the cold-weather crops, of which only a small area was raised, the yield was satisfactory, 14·5 acres giving an average of 633·5 lb. grain and 6,647 lb. straw. In the case of Crop No. 8, in the table, however, the yield of grain is very low and much more so than was anticipated from the appearance of the crop; for, although the ears were rather small, the crop was a good one: the small outturn was no doubt partly due to the fact that a series of seed-sowing experiments were conducted in the field, and I think that considerable loss was experienced by petty pilfering, and in harvesting and threshing the crop.

41. *Crop No.* 10—*Black Cholum* (*Sorghum saccharatum?*) is notable; the seed was obtained from the Trichinopoly District, and the crop resembles the Chinese sugar-cane very closely, except that the husk of the seed does not adhere nearly so closely to the grain as it does in that crop; whether it possesses the same sugar-producing qualities cannot be settled as yet; but as far as we can tell it does not do so, but this may be due to long-continued deficient cultivation. In Trichinopoly the crop is raised on the poorest soils I saw under cultivation there and is the staple food of the people in the southern part of the district. The soil of the Field No. 32, on which this crop was raised, is a sandy loam, well drained, of tolerably uniform condition throughout, and the differences caused by the levelling of its surface five years ago are scarcely observable now, and most of the trees that then interfered so greatly with the proper cultivation of the land have been removed. The crop followed horse-gram which was cut for green fodder in the middle of August. There being but little time available for the preparation of the land for sowing, it was ploughed only once, and, after being manured with horse manure at the rate of five tons per acre, was ridged up and sown on alternate ridges with black cholum and cotton. The seed germinated very well and the plants grew very vigorously at first, but, during the dry weather of September, the crop became so much stunted that its loss seemed certain at the end of that month; however, the rain at the commencement of October revived it again and afterwards it grew very vigorously, attaining a great height and developing remarkably good ears. The yield (1,265 lb.) of grain per acre was very good and one never obtained previously from any cholum crop raised on the farm. Such an outturn shows clearly that the crop is suited to our soil, but must be chiefly attributed to the good condition of the land; the two preceding crops, white cholum—a cold-weather fodder crop raised in 1878-79, and the horse-gram fodder raised as a hot-weather crop in 1879—were not good, so that the soil lost little of its fertility in producing them.

Crop whence derived.

Soil on which grown.

Preparation for crop.

Growth of crop.

Outturn.

42. *Crop No.* 13—*Planter's Friend* (*Sorghum kaffrarium*).—The field (No. 27) in which this crop grew is one of the worst on the farm: it was levelled about four years ago, at which time it was necessary to strip the land in some parts more than a yard deep in order to bring its surface to a regular slope. The bad effects of removing the surface soil have been shown by barrenness of the land stripped, the stiffer portions of it having produced little or no crop ever since. The soil varies from clay to sand; the portion stripped most deeply is stiff, and has a very close texture so that even after a light shower of rain the water accumulates on the land and whenever heavy rain is followed by great evaporation salt rises and is deposited on the surface. The land was ploughed several times between June and August and was as well prepared for sowing as the diversity of the soil admitted. Horse manure was applied at the rate of nine tons per acre, after which the Planter's Friend was sown on alternate ridges with cotton. The seed germinated freely and tolerably evenly over the ground. The dry weather of September was unfavorable for the growth of the plants, and they appeared stunted

Poverty of soil.

Preparation of the land.

at the end of the month, but recovered tolerably well after the rains at the commencement of October. The yield, 499 lb. of grain per acre, is, considering that the land was unable to carry any other crop before, good. The crop grew on the stiff as well as it did on the sandy soil and in the salty portions of the field. It is the only crop that has grown at all well on the land. Planter's Friend having a very thick and succulent stem is a first-rate fodder crop and yields heavily; and it is more highly valued in America as a sugar crop than the Chinese sugar-cane even.

Outturn from crop.

43. *The irrigated cereal crops* raised during the year were grown on an area of 14·43 acres; of this, 9·23 acres are irrigable from the Mylapore Tank; 3·71 acres are situated in the river-bed south of the farm buildings, and the remainder (1·49 acres) was irrigated from wells, &c., with water raised by mechanical agency. On the land irrigated from the Mylapore Tank 12·57 acres of paddy were raised and harvested during or shortly after the end of the year, as well as one acre of raggy grown on land that also produced a crop of cumboo (No. 4 in the table); besides this, on portions of the area, in all 7·7 acres, horse-gram fodder (1·84 acres) and gingelly seed (5 86 acres) were raised, which will be referred to in their proper places. The total area of crop raised on this piece of land was thus 21·27 acres. On the river flat 4·64 acres of paddy were raised and the results are recorded in the table, but there are also several plots in the same place, still carrying paddy of different ages, which are not referred to in the statement.

General results.

44. Crops of Carolina paddy were sown at different times of the year; but, though every care was taken with them, they failed. With Madagascar paddy (see paragraph 56 of last year's report) better results than last year were obtained, Crop No. 18 being a good one. Ths crop has a very valuable characteristic in that the plants tiller largely, and thus a small quantity of seed will suffice. The crops raised this year matured in a much shorter time than last year, probably because the plant has become more thoroughly acclimatized. The crops of white car paddy were satisfactory: No. 20 was raised on a piece of poor sour land, lying close to the Mount Road and consequently a portion of it is within the reach of the roots of the fence and trees alongside the road, and these no doubt have an injurious effect on the productiveness of the land; No. 21 was raised on land very similarly situated, but of better quality, and the outturn is very good. Some of the land producing the crops referred to above was manured with a crop of horse-gram ploughed in green, other portions produced a crop of gingelly seed or horse-gram fodder and on nearly all at the end of the year a catch crop of indigo was put down after harvesting the paddy crop; this crop, however, does not appear in the statements.

Satisfactory results with Madagascar paddy.

Good results with white car.

45. *Car Paddy.*—Crops 23—30 were all raised on Field No. 37; No. 23, with Madagascar paddy No. 18, succeeded Carolina paddy No. 14, and was a very satisfactory crop; on Plots II, III, IV, and V crops of horse-gram fodder were raised during the dry weather last year, which will be found recorded in their proper place, and it is very evident that the land was much benefited by their growth, for formerly the land rarely produced a fair crop. Following the horse-gram, gingelly seed was sown on these plots, the outturn from which is also recorded elsewhere. Plots III, IV, and V, it will be noticed, produced a double crop, whilst on Plots I and II a catch crop of indigo was sown after harvesting the paddy. The returns from Plots I (*b*), II, and III are satisfactory, but the others rather low.

46. Nos. 31 and 32 were both raised on the same plot, but with No. 32, on a small portion of fair soil at one end, a small piece of Carolina paddy was grown, which does not appear in the table, as it is standing. The plot is a very poor one, with inferior drainage; and the yield of car paddy is low. A few days after harvesting that crop, the land was again sown with what is called sixty-days' sumba paddy (in reality a ninety-day crop), which matured in eighty-two days. In order to stimulate its growth, the crop received a slight top-dressing of sheep manure when about nine inches high. The outturn is low, but better than that received from the first crop. The plants were attacked by an insect when about nine inches high, which caused the death of many and thus reduced the yield. No. 33, car paddy, was grown on a plot situated close to that mentioned above. The soil is in tolerably good condition and the outturn was fair.

47. Nos. 34—40 were all raised on land in river-bed south of the farm buildings; the surface of the land is nearly of the same level as the water in the river. Crops Nos. 34—36 were raised during the hot weather of 1879, and the remainder early in the present year; as we had no heavy floods during the past season, the last-named crops were grown at a very small cost. The plot (No. 35) that yielded in 1879 at the rate of 930 lb. grain per acre is below the water-level of the river at ordinary seasons; the soil of this plot was in previous years so impregnated with salt that nothing would grow on it. The improvement of the land must be chiefly attributed to a drain cut close to it, by means of which the surface water can be let off and which also provides some drainage. The outturn of straw per acre is high in Nos. 34 and 35, most probably on account of the lay of land; moist ground having a tendency to produce thick haulms but not much grain. The outturn from the crops recently harvested was considerably

better than that obtained last year, showing that the land continues to improve under the treatment it has received, and, the crops having been raised at a very small cost, is very satisfactory.

48. No. 41, Raggy following cumboo (No. 4 in the table) on a part of the same field was raised on a field the soil of which is very much impregnated with soluble salts and the outturn is consequently fair. The crop was occasionally watered.

No. 42, Maize was raised on a part of the same field as Crop No. 9 in the table; it was sown during the hot season with a view to propagate the small amount of grain then available in order to have sufficient seed for sowing during the cold weather. The result, however, was not satisfactory. A great number of cobs were received, which, however, were all very small, each cob yielding on an average only $1\frac{1}{4}$ oz. of grain, whereas good-sized cobs raised previously yielded more than 8 oz. of grain.

49. *The Pulse crops* recorded occupied an area of 6·42 acres and yielded an average outturn of 147 lb. grain and 1,709 lb. straw per acre. The crops were all, except No. 47, put down together with gingelly very late in the season. They received no special attention during their growth, and consequently cost little to raise. The yield of green-gram, except from Field No. 15, was fairly satisfactory; but our soil is not at all well adapted for crops of this class, and they can only be put down as catch crops on land which remains unsown late in the season, as they will mature with a minimum supply of moisture.

50. Besides the above-named crops 5·48 acres of dholl (*Cajanus Indicus*) were raised, chiefly amongst Casuarina trees for shade, the results of which will be given next year, as the crop was still standing at the end of the year.

51. *Industrial Crops.*—Several of the crops given in the Appendix are those sown in the year 1878, but harvested during the year under report, and consequently the figures do not exclusively refer to the work of the year; during the past year, however, the following areas were put down under the descriptions of crop named:—

	ACRES.
Cotton	16·40
Oil-seeds	31·78
Indigo	3·71
Tobacco	0·50
Sugar-cane	·87
Total ...	53·26

Of these, the results from the cotton and sugar-cane, part of the indigo (1·78 acres) and part of the oil-seed crops (2·73 acres) cannot be given till next year, and these crops are not referred to in the Appendix. Besides this 12·7 acres of poor land were planted out with Casuarina trees.

52. *Cotton*—New Orleans.—The crops mentioned were referred to in paragraphs 52 and 91 of last year's report; the outturn, averaging 449 lb. of seed-cotton per acre, is, considering the conditions under which the crops were raised, satisfactory.

53. *The Oil-seeds* referred to in the table are Castor beans (*Ricinus communis*) and gingelly (*Sesamum orientale*); of the former, Crops 4 and 5 were raised in order to form shade for the young Casuarina trees, but, being put down very late on very poor soil and meeting with adverse conditions, they died off very early and neither produced much seed. Crop No. 6 was raised from seeds grown in the Botanical garden of the Italian varieties referred to in the report of those grounds (paragraph 34) for last year, and is very satisfactory.

54. *The Gingelly crop* may be divided into two portions; the hot-weather crop occupying an area of 21·29 acres and yielding on the average 78 lb. of seed per acre; and the cold-weather crop, which occupied 7·76 acres and the average outturn recorded being 222 lb. of seed per acre. The hot-weather crop suffered during July, as has already been explained, which chiefly accounts for the low outturn recorded, but to some extent it is also attributable to the bad weather experienced after harvesting, which necessitated frequent turning of the plants in the yard to dry them, during which much of the seed was shed and a good deal became mouldy and valueless. Gingelly is always a difficult crop to harvest in unsettled weather as the seed is so easily injured. Crops Nos. 10—14 were raised on ordinary paddy land irrigable from the Mylapore Tank; the soil of all the fields (except 36, which is very poor and sour) is a sandy loam in tolerably good manural condition. The crops suffered from the dry weather of July and the outturn was nearly everywhere very low from the causes referred to above; however, the outturn of 144 lb. per acre in Field No. 35-IV is not bad considering the conditions the crop had to contend with.

Badness of season for hot-weather crops.

Crops grown on paddy land.

55. The cold-weather crops, Nos. 15—20 in the statement, were the first of this crop raised during this part of the year. They were sown very late, in fact after the usual season for sowing cold-weather crops, in alternate double lines with gram; when the crop was

Manner of sowing cold-weather crop.

put down, the chief object of sowing a mixture of seeds was to avoid the risk of total failure which might attend a single crop, especially as the season was too far advanced to admit of sowing any later crop; however, as both crops grew very well both were left to mature. The crops varied, as might be expected, with the varied conditions of the soil. In the loamy and more fertile portions the gingelly predominated, and on the sandy portions where gingelly had less chance, the gram grew well. The experiment was, on the whole, very successful; not only did the gingelly grow very well in most instances, but it was also not directly manured nor even hoed, the only operation performed during the growth of the crop was harrowing several times across the lines for the purpose of breaking the crust and loosening the soil and to thin out the plants which had sprung up rather thickly, owing to the large amount of seed used. The harvesting was much easier than that of the hot-weather crop, for the weather was settled and dry; whilst at the time when the latter is being harvested, which is generally in August or September, there is generally great pressure of work, it being the time for putting down the cold-weather crops, and as the weather is then generally showery, much of the gingelly either becomes mouldy or is entirely spoilt. In this case the crop was harvested at the end of March and the commencement of April; and the season being very favorable, the cost of preparing the seed for sale was very low; all that was necessary was simple turning of the plants over several times in the open yard; by which means all the seed was shed and then only required to be winnowed. The seed raised at this season was sold easily and more advantageously than that obtained from the hot-weather crop. The outturn per acre was in some instances very good; Field No. 34-I yielded at the rate of 511 lb. per acre, a very good crop; it followed a crop of indigo (No. 27 in the table). The lowest outturn was obtained from Field No. 21, the yield being only 98 lb. per acre; the soil in this field is chiefly sand and is in very low manural condition. The gingelly had not much chance of thriving under these conditions, but the gram raised with it was a very good crop, yielding more than 16,000 lb. of fodder per acre.

Treatment of crop.

Facility for harvesting.

Preparation for market.

Outturn of crops.

56. *The Indigo* crops mentioned in the table were all, excepting the last (No. 28), sown at the close of the cultivating season of 1878-79; they were all put down very late and the outturn is very low; those from which green plant was obtained only averaging forty-nine bundles per acre or about one-fourth of a fair crop; in every case, however, except with Crop No. 21, only one cutting was obtained instead of three as usual. Crop No. 25 was raised on a piece of ordinary paddy land; the field is unfavorably situated, the soil is poor and in a bad physical state, and the season was unfavorable; the crop was watered occasionally, and considering the circumstances, the yield in one cutting, forty-six bundles per acre, is not altogether unsatisfactory.

57. The crops raised for seed during 1878-79 yielded but poorly. Crop No. 27, from Field No. 34-I, was grown on a piece of land well situated as regards drainage, and also for irrigation. The soil is a sandy loam in good condition. Immediately after sowing the seed, the land was irrigated, and also occasionally afterwards. The seed germinated tolerably well and the plants spread very much and grew to a great height, many of them measuring five feet. The plants all flowered very well and were thickly covered with pods, most of which, however, were empty; the yield of seed was consequently low. The plants produced very thick stems and branches, which made the cutting difficult; they were therefore cut about 1½ feet from the ground and the stubble was ploughed in afterwards. If they had been cut in the usual way a few inches from the ground the outturn of plant would have been about twice the amount recorded.

58. Crop No. 28 was a very fine one and attracted a good deal of attention from the native cultivators in the neighbourhood. The yield of seed, 382 lb. per acre, may be noticed as being very satisfactory and especially so as a considerable demand arose for it. All that could be spared from farm purposes was sold as soon as it was threshed, and much more could have been disposed of if it had been available.

A very satisfactory seed crop.

59. *Tobacco*—Crop No. 29 is that referred to in paragraphs 79—82 of last year's report, and is simply entered for record; regarding this, and the other crop raised in 1878-79 it may be observed that the leaf was reported on by competent persons as being fairly cured, even in color, and of good smell, but possessing the fatal characteristics (for a cigar tobacco) of burning slowly, not keeping a light well, and yielding a black ash, all defects which I believe can be overcome by treatment of the crop, and with this object some small experiments have been made with different manures in the Botanical garden of the School of Agriculture.*

Quality of leaf produced.

Crop No. 30 was raised on a fair piece of land and was, like the crops of the two previous years, very successful as regards outturn. This year the tobacco was raised without the aid of special manure and irrigation, which in a measure corroborates the opinion expressed last year

Growth of, without irrigation.

* Samples of the tobacco raised in this manner have been already forwarded for analysis.

that tobacco if planted early may be raised without irrigation, although something was no doubt due to the exceptional season experienced. There can be little doubt that, if it can be grown successfully under such conditions as this crop was raised, when tobacco is grown either for the manufacture of cigars in this country or for export, it can be made one of the most profitable crops of the plains. Samples of this tobacco will when fit be submitted for analysis, if it be found to possess the objectionable characteristics noticed in that raised last year.

60. *Sugar-cane.*—A small plot (·87 acre) was planted with this crop on the 21st December 1879 and is doing fairly; the results will be given next year. One-half of the plot was planted with rows three feet apart and the other with the rows six feet apart; the former has so far done much better, and appears likely to give the best results, as the ground is much more thoroughly covered, and so evaporation is checked.

61. *Casuarina Trees.*—Those planted out in 1878-79 have progressed, for the most part, very favorably during the year under report, and are now nearly safe from the effects of a prolonged dry season. They cost comparatively little for watering, and will in a few years largely increase the value of the property; the land they have been planted on is not fit for any other purpose, and, as fruit and hardwood trees will be planted amongst them, it will become a permanent source of revenue instead of useless expense in keeping up appearances. During the season just concluded 9·2 acres of the remaining poor land were planted out, and up to the present the trees have done very well on the whole. They were planted on ridges raised with a plough only, alternate ridges being sown with dholl for shade, which method has turned out very satisfactorily. Besides the area above mentioned about 3·5 acres of land, which has for years been lying waste and unutilised in various corners of the farm, was successfully planted in the same manner. In the current year I hope that all the remaining pieces of waste land on the estate will be planted up, and also it is intended to plant a few acres of land which is of such inferior quality as not to be worth cultivation. When these operations have been completed it will be possible to utilise the annual expenditure to greater advantage on the more limited area of land of fair quality still remaining.

Growth on poor land.

Utilization of waste land.

62. *Fodder crops* are referred to in Statement C of Appendix II; those mentioned do not comprise all that were raised, as a large area was under guinea-grass during the year, which was both grazed and in some cases cut over, and other crops still not harvested will be referred to next year. As already mentioned the season was peculiarly favorable for fodder crops. Large areas of horse-gram were also used as green manure, not being required for fodder. Fodder-growing for dairy purposes is no doubt one of the most most profitable branches of husbandry in this locality, but, as long as the Commissariat Slaughter-yards remain on the Farm, the purchase of any number of cows would be unwise.

63. *The Irrigated Cereal* fodder crops call for no very particular remarks, except to point out the success obtained in growing cholum on our paddy land, which a few years ago could not have been done owing to the condition of the soil; and to notice crop No. 4, which in a great measure settles the question whether Chinese sugar-cane can be raised during our hot season; this crop is a most valuable fodder-producer, as the green stem is so much relished by cows, and because it exerts a beneficial influence on the flow of milk. None of the crops mentioned were irrigated more than occasionally.

64. *The Unirrigated Cereal* fodder crops nearly all gave a low outturn, but, as most of them were simply grain crops that had failed and were cut out green to make room for some other crop to follow, this is not surprising. With guinea-grass several very satisfactory cuttings were recorded, amongst them the following:—

No.	Field and Plot.	Area.	Date of Harvest.	Outturn per Acre.
		ACRES.		LB.
1	22-I ..	2·95	4th Oct. 1879.	4,136
2	23-II ..	1·50	1st Mar. 1880.	8,555
3	27-III ..	2·11	11th Oct. 1879.	9,923
4	29-III ..	1·00	15th Mar. 1880.	9,680

Of these Nos. 2 and 4 were only put down during the past season, having been planted in October and December respectively, and the cutting recorded is the first obtained from them.

65. *The Leguminous* fodder crops recorded are most of them very satisfactory, and several heavy crops which remained uncut at the end of the year are not included. No. 13 was raised on a field that has in a great measure been ruined by the original soil having been covered with the sand and clay removed in excavating the large irrigation channel which passes through the western end of the Experimental Farm. Horse-gram is the only crop that has succeeded at all on this field, and the outturn now recorded is very satisfactory. Nos. 15 and 16 were raised on the paddy beds referred to in paragraph 45 above and are very encouraging, as they show how much the condition of these fields has been improved of late years by thorough

and deep cultivation. Nos. 22 and 23 were both sown in alternate double lines with gingelly as described in para. 55 above, but, as the amount of seed that was on the plants was not worth threshing out, they were simply recorded as fodder crops; the outturn, 16,753 lb. per acre, from No. 22 is extraordinary and is the best ever obtained from this field, a part of which was drained (see paragraph 32).

66. *Miscellaneous crops.*—Amongst these may be mentioned plantains, of which several small plots were growing or put down during the year, but concerning which there is nothing specially worthy of report. One plot was so severely damaged during the cyclone in May that it was considered advisable to remove the plants. In August 147 shoots of Manilla hemp (*Musa textilis*) were obtained from Captain Cox of Wynaad and planted amongst the plantain trees on a part of No. 4 field; since then they have done tolerably well. Only a few of them died after planting; these had been injured during transit. Those plants which were planted near the irrigation channel have grown most vigorously; these were about 10 feet high on the 1st of April, but it is yet too early to draw any conclusions from the experiment. The plants were treated like the common plantains as regards planting, watering, and hoeing.

67. An acre of land in No. 8 field was planted with brinjals (*Solanum Melongena*) on May 17th, and up to October 17th 1,435 lb. of fruit were obtained. The soil of the plot is a sandy loam in good manural condition; the crop grew very well at first, but at the time of flowering and during the whole time the plants were bearing it was attacked by insects, which checked the growth of the plants and reduced the yield. As the fruit also was attacked, the produce had to be sold below the market price. The plants were, immediately after they commenced bearing, so much attacked by insects that the total loss of the crop seemed certain. Some cart-loads of ashes were then strewn over the plants, and they soon afterwards recovered. It is probable that the attack of the insects was due to the manuring given to the crop, and that newly-manured land was especially favorable for breeding them.

68. A small plot (·15 acre) was sown with coriander for the first time on the Farm as an experimental crop. It followed New Orleans cotton. The soil is a sandy loam and received no special manuring: the seed was sown on ridges in the usual manner, but evidently from the result not thickly enough. The crop was not watered and gave an outturn at the rate of 413 lb. per acre, calculated at 1 anna per lb., which is below the market price; this would be worth Rupees 25-13-0 per acre, which, considering that the crop was only 82 days on the ground, is satisfactory.

MANURES.

69. During the past year the following manures were used on the Farm:—cattle-box, sheep, and horse manure, refuse of the slaughter-yards, ashes, crushed bones, and lime.

Cattle-box manure.

70. The cattle-box manure is obtained from the Farm cattle; they are generally kept in the boxes during the whole night and a few hours at noon. The excrements they drop in the boxes with the bedding supplied are allowed to accumulate for three or four months by which time the manure partly decomposes and is then carted at once to the fields. The manure accumulated during the hot weather is chiefly used for manuring of cold-weather crops, such as cotton, &c.

Sheep manure.

The sheep manure was obtained from the Farm sheep kept in covered pens and was chiefly used for top-dressing paddy crops. In several cases this manure had most remarkable effects on that crop; some crops that had suffered so much from the attacks of insects that it almost seemed advisable to plough them up were so much invigorated by a dressing of sheep manure that they gave a fair outturn.

Horse manure.

The horse manure was obtained from the Batteries stationed at St. Thomas' Mount at the rate of five cart-loads per rupee. The manure is valuable when well decomposed, but is of little use when fresh on account of its bulk and the living grass roots it contains. The cotton fields, Nos. 27 and 32, as well as several of the guinea-grass fields, were entirely manured with horse manure.

Slaughter-house refuse.

71. The refuse of the slaughter-houses consists of the refuse obtained from the Commissariat yards mixed with ashes, and allowed to lie in pits for some months to become thoroughly deodorised. It was chiefly applied to fields that required a stimulating manure.

Ashes.

The ashes were obtained from Sáidapet at the rate of 1—2 annas per cart-load, a price which shows how little they are prized in this neighbourhood. The ashes purchased were chiefly paddy-husk ashes and nearly free of sand, &c. Ashes are the cheapest manure available on this Farm, and their use combined with green manuring is the simplest and most economical manner of getting our soil into good condition. Paddy-husk, containing a large percentage of valuable plant food, and especially phosphate of lime, must yield a most valuable manure for raising grain crops.

Crushed bones.

72. The crushed bones, being rather coarse, were nearly all put into the slaughter-house manure pit to decompose, as they would have been of little use for application in their coarse

state. Lime was used for indigo in one of the rotation and for several other fields; as it is rather expensive here, it is not extensively made use of; the lime needed for the crops can generally be applied much more cheaply in the form of ashes. Besides the manures mentioned above during the year 48·14 acres of horse-gram were raised and ploughed in as a green-manure. By this means the Farm soils will be gradually improved and increase in value.

Lime.

Green manure.

73. Large sums of money have already been spent on manure both in the form of artificial food supplied to stock and in the purchase of manure, but still, owing to the original poverty of the soil and also from the extensive levelling operations which have been carried out, much remains to be done before many of the fields will be fit for regular cropping, and more particularly for experimental work, either in carrying on manuring experiments or in raising a variety of crops. By getting rid of the poorest land, which has been planted out with the only crop it is fit to produce, the expenditure with this object will be more usefully directed than it has been in former years. During the past year, including one-third of the cost of artificial food supplied to stock debitable to this heading, the total expenditure on manure was Rupees 1,086-13-4, besides the cost of raising the green-manure referred to above.

Necessity for heavy manuring.

74. As already explained the state of the soils of the farm is such as to preclude carrying out many manuring experiments of any particular value; the results of such experiments as have been made will, however, appear in the records, but no striking ones were obtained. Several experiments were commenced and are being proceeded with, which have for their object the demonstration of the inadvisability of burning cattle-dung for fuel; for, although it is plainly evident that the practice is a suicidal one, still there are those who under-estimate its pernicious effects, and the experiments as yet made have not been made under conditions such as would demonstrate the fact very clearly, although they have all tended to bear out the natural deduction from scientific reasoning.

LIVE-STOCK.

75. *The stock-breeding experiments,* which it was resolved in 1875 to proceed with, are still deferred chiefly because the Commissariat Slaughter-yards still remain on the farm, for it would be most unwise to keep valuable stock here as long as these yards remain where they now are, right in the middle of, and only accessible by passing over a considerable portion of the roads of, the farm. Last year* the fact that these yards being on the farm caused a great deal of trespass, and petty pilfering was brought to notice, and the necessity† for their removal has frequently been referred to in previous annual reports. This year the farm has suffered more severely than ever from their presence; there was an outbreak of foot-and-mouth disease (*Epizootic aptha*) amongst our sheep in October 1879 from which we lost 7 sheep and the whole flock was severely tried; following this we have had an outbreak of sheep-pox (*Variola ovina*) in February last from which up to the end of the year we had lost 15 sheep, when it was still present in our flock, and has since caused further deaths;‡ both these outbreaks can only be attributed to diseased sheep being driven through the farm on their way to the slaughter-yards, and so bringing in the infection, for our sheep are never allowed to go beyond the limits of the farm, which is also extremely isolated. Besides these losses I may mention that we have since the end of the year lost three bullocks, all employed at the slaughter-yards in removing the blood refuse for manure, from what was determined to be "rinderpest," and that the disease can only be traced to diseased cattle having been brought in for slaughter. It will thus be seen that the farm has experienced heavy direct losses from the presence of these yards, and the nuisance, trespass, and petty pilfering, &c., previously complained of still remains unabated. This being the case, the advisability of the removal of the yards is very evident.

Nuisance of slaughter-yards.

Losses from disease caused by presence of slaughter-yards.

Desirability of removing slaughter-yards.

76. *The cattle* during the year were generally very healthy; they were kept in the usual manner in loose boxes on the manure accumulated in the pits sunk therein. The foot-and-mouth disease, which attacked the sheep, did not spread to the cattle. The cows were kept in a separate shed, but not on the manure, it being removed daily, and the floor of the byres sanded.

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* Paragraph 92 of the Report.
† Do. 94 do. for 1877-78.
Do. 87 do. for 1876-77.
Do. 46 do. for 1875-76.
‡ From April 1st up to June 28th 70 deaths occurred from this disease, and the constitutions of many more sheep have been ruined.

77. *The Aden Cow* referred to in paragraph 99 of last year's report continued to give milk until 17th May; she yielded as follows, bringing forward the record of last year:—

—	Quantity.		Value.		
	MRS.	OLLS.	RS.	A.	P.
From July 1878—March 1879	610	1½	101	11	2
April	70	2½	11	11	6
May, up to 17th	13	5	2	4	4
Total ..	694	1	115	11	0

The cost of producing this milk was as follows, no charge being made for the fodder supplied, the manure being taken as of equal value to it:—

		RS.	A.	P.
Brought forward from 1878-79		30	11	2
Charges in 1879 up to birth of next calf.	459 lb. of cake	9	0	2
	122 lb. of bran	2	7	0
	376 lb. of tour	2	10	11
	Attendance and sundries	5	8	0
Total ...		50	5	3

At the end of this period there was a calf worth about Rupees 12, so that the cost of the milk produced was Rupees 38-5-3, or 11 pies per measure; it was sold at the rate of 2 annas 8 pies per measure.

This cow calved again on the 27th August 1879, and had up to March 31st yielded milk as follows:—

—	Quantity.		Value.			—	Quantity.		Value.		
	MRS.	OLLS.	RS.	A.	P.		MRS.	OLLS.	RS.	A.	P.
September	122	1¾	20	5	11	Brought forward ..	433	5¾	72	4	7
October	112	4	18	12	0	January 1880.. ..	104	2½	17	6	2
November	117	1½	19	8	6	February	82	2	13	11	4
December	81	6½	13	10	2	March	81	4½	13	9	6
Carried forward ..	433	5¾	72	4	7	Total ..	701	6¾	116	15	7

The cost of maintaining her during this period was—

	RS.	A.	P.
517 lb. ground-nut cake	9	11	8
525 lb. bran	10	8	0
90 lb. tour	0	10	3
Attendance and sundries	10	12	0
Total Rupees 4-8-3 per mensem, or ...	31	9	11

At the end of the year she was yielding milk at the rate of 2 measures 4½ ollocks per diem and is expected to calve again about the end of July. That this cow is a very good milker is evident from the following figures:—

	Amount.	
	MRS.	OLLS.
Calved May 1877, yielded milk for 48 weeks	832	3
Do. June 1878, milked from July 15th, 1878, to May 17th, 1879, yielded	694	1
Do. 27th August 1879, yielded milk in 7 months up to 31st March 1880	701	6¾

Desirability of importing fresh blood.

It is fortunate that we now have two heifer calves with which to perpetuate the breed, but it will be necessary to obtain some fresh blood from Aden, in order that we may not be obliged to cross them both at least. When the Commissariat slaughter-yards are removed it will be advisable to obtain another pure-bred bull and another full-grown cow, as the breed has shown itself to be a valuable one for the dairy, and as such useful for the improvement of the stock of this country.

78. *The Nellore Cow* referred to in paragraph 100 of the last report continued to yield milk throughout the year; the yield obtained from her up to March 31st last was as follows:—

—	Quantity.		Value.		
	MRS.	OLLS.	RS.	A.	P.
Received previous to March 31st, 1879.. ..	114	1½	19	0	6
„ April	75	6½	12	10	2
„ May	71	..	11	13	4
„ June	76	4	12	12	0
„ July	68	3	11	6	4
„ August	65	5½	10	15	2
„ September	74	6	12	7	4
„ October	62	6	10	7	4
„ November	52	2	8	11	4
„ December	36	2	6	0	8
„ January	43	7	7	5	0
„ February..	35	4½	5	14	10
„ March	36	1	6	0	4
Total ..	813	1	135	8	4

She was yielding at the end of the year at the rate of 1 measure per diem, and her calf was then worth about Rupees 18; during the year she cost for maintenance, &c.—

	RS.	A.	P.
976 lb. ground-nut cake	15	6	3
647 lb. bran	12	15	0
466 lb. tour	3	5	3
Cost of attendance and sundries	12	4	0
Total ...	43	14	6
Charges incurred in 1879-80	6	2	2
Grand Total ...	50	0	8

so that the cost of the milk received was 7·6 pies per measure; she was not in calf at the end of the year.

79. *Punganúr Cattle.*—In November 1879, with a view to test accurately the milking capacities of this breed, which has a considerable reputation in this respect, three cows with young calves and a bull were purchased at Punganúr and brought to the farm; one cow was not received until 30th January 1880. They are all small animals, the cows averaging in weight 413 lb. They have been kept and fed like the two cows above referred to, which is something as follows:—

The cows are at 6 A.M. milked in the presence of the Storekeeper, after which they are allowed to graze until about 9 o'clock. From 9 A.M. until about 4 P.M. the cows are kept in the shed and are then again milked, after which they are brought to their byres for the night. The cows are fed twice a-day at milking time. They receive 6 lb. of bran, 2 lb. of cake each with a little salt, and green fodder *ad libitum* per diem.

This breed appears to be very hardy, but the cows are rather wild; no European can safely go close to them. Their calves have all done very well. The bull has been used for light work in the cart and plough during the last few months of the year; but being of light make he will not be fit for heavy work, although he may become very useful in the harrow, bullock-hoe, and for other work where speed is required.

The yield of milk from the three cows is given below:—

—	Quantity.		Value.		
	MRS.	OLLS.	RS.	A.	P.
January, 2 cows	72	7½	12	2	6
February, 3 cows	92	0½	15	5	6
March, 3 cows	109	2½	18	3	6
Total ..	..	..	45	11	6

The cost of producing this milk was as follows:—

	RS.	A.	P.
182 lb. ground-nut cake	3	1	8
392 lb. bran	7	13	5
401 lb. tour	2	13	9
Attendance and sundries	6	14	0
Total ...	20	10	10

80. *The Sheep* flock suffered severely from disease during the year, especially in the latter part, as mentioned above; otherwise it progressed satisfactorily. The number of lambs born was 81 from 88 ewes placed with the rams: of the latter however 7 were barren and 2 dropped their lambs dead. The lambs suffered a great deal from their mothers having been attacked with foot-and-mouth disease during pregnancy, and many of them were small and weak, which caused a good many deaths during the last two months of the year. The following table shows the strength of the flock and death-rate for the past few years :—

—	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.	1879-80.
Average number of flock..	207	221	237	275	295	274	251
Number of deaths	16	24	21	11	31	34	55
Percentage of deaths	7·73	10·9	8·9	4	10·5	13·14	21·9
Rainfall in inches	48·07	68·98	38·14	20·88	65·55	33·16	56·95

Between December and February 39 rams were distributed in the Mofussil, being despatched to the Collectors of the following districts :—

North Arcot	2	Chingleput	2
Kurnool	2	South Arcot	8
Salem	9	Trichinopoly	6
Coimbatore	4	Madura	6

A few more would have been sent out had not small-pox shown itself in the flock, and it is hoped that some more will be distributed during the current year. The animals sent out were not quite the best we have, as these were kept for breeding purposes; but they were decidedly better shaped and woolled than the ordinary sheep of the country and it is hoped may produce some small effect where they are used.

81. *Pigs and Poultry.*—There is nothing particular to record regarding these descriptions of live stock; the former were healthy throughout the year, and a considerable number of eggs from the latter were disposed of to various people for setting in different localities.

82. In Appendix III of this report statements are given showing the stock maintained on the farm during each month of the year and the value of the artificial food supplied, and in the following table several details of interest regarding them for the past four years are shown :—

—	1876-77.	1877-78.	1878-79.	1879-80.
Live stock maintained, calculated as country cattle..	132	135	123	125
Stock, as country cattle, per 100 acres of cultivable land	82·5	84·375	84·24	88
Percentage of deaths	7·6	12·9	8·9	8·8
	A. P.	A. P.	A. P.	A. P.
Cost of purchased food a head per mensem	8 6	10 6	14 5	12 1

A reference to the appendix will show that the sheep stock is the one on which the heaviest expenditure is incurred, and it has hitherto been in a great measure unremunerative, although much has been done towards the improvement of the breed, an object which merits considerable expenditure on the part of Government. Besides costing a large sum annually for artificial food, the sheep require a considerable expenditure on labor owing in a great measure to the necessity for keeping the rams, ewes, and young sheep separate, and hitherto the manure obtained from them has not been fully utilized, but now that the farm has been supplied with hurdles, it will be made better use of by folding the sheep in the fields.

IMPLEMEMTS.

83. *The ploughs imported from Sweden* continue to give favorable results whenever deep ploughing is required and when the soil is rather dry. The single stilted plough has been mostly in use; it being of very simple construction and at the same time strong and effective is very well adapted for hard soil, especially as the draught required is moderate. During the past year a plough of this pattern was made up on the farm for Rupees 20, which is a very moderate price.

Cheaper Ploughs.

84. The light American pattern plough referred to in paragraph 110 of last year's report continues to give fairly satisfactory results. Several ploughs of this pattern slightly altered were made for Rupees 7-8-0, as well as some of the larger pattern with some alterations; the latter being simpler can be made much more cheaply than the original without loss of effectiveness; they have been made in the workshop for Rupees 10 without a wheel and for Rupees 12 with a wheel; the first-mentioned plough (price Rupees 7-8-0) promises to be one of the best yet adapted to Indian conditions.

85. A plough was received during the year from Dr. J. Macgregor, Superintendent of Central Jail at Benares, which is built on quite a new plan; it has the advantage of being very light and short, and is in this respect especially suited to the wants of the native cultivator; it was tried several times on the farm, but, as the soil was rather hard each time, its working qualities could not be shown advantageously. The cost of this plough is Rupees 12.

A plough was also received from the Department of Agriculture and Commerce, N.W.P.; price Rupees 5-8-0; it is a modification of the American plough, and is light and easily transportable, but is less compact than the Benares plough, and, from the manner in which it is put together, will not admit of rough treatment. It has not as yet been tested in the field.

86. A number of the ploughs in common use on the farm were tested during the year to compare their effectiveness under certain conditions. The trial was made in the southern portion of field No. 29; the soil is a sandy loam and was in a very favorable state for ploughing at that time, so that the conditions were rather more advantageous to English ploughs than for those received from Sweden. If the soil had been drier, the good qualities of the Swedish ploughs would have been more clearly shown. At the same time two ploughs (Nos. 6 and 7 in the statement) imported by Messrs. Oakes and Co. from America were also tested, as well as the two American ploughs imported in 1875. The following table gives the results, the data for calculating the comparative efficiency being the amount of work done in a given distance and the draught required to move the ploughs:—

Description of Ploughs.	Furrow.		Cubic Yards of Soil moved in each 100 Yards run.	Draught.	Comparative Efficiency.
	Depth.	Width.			
	INCHES.	INCHES.		CWTS.	
1. Ransome's plough	4·8	10	3·7	1·75	100
2. Howard's do.	4·8	10·6	3·9	2	92
3. Single stilted Swedish plough No. 29	4·85	11·65	4·4	2·125	98
4. Swedish plough No. 40	5	9	3·5	2·2	75
5. Do. No. 34	5·17	9	3·6	1·725	99
6. Collins' plough, No. 106 (I. F.)	7·87	10·6	6·4	3·75	80
7. Do. No. 107 (do.)	7·35	9·9	5·6	5·05	52
8. American plough, Rs. 22	4·65	6·85	2·45	1·875	62
9. Do. do. „ 17	6	10·15	4·7	5·225	43

It will be noticed that the plough of Ransome's make heads the list; the only objection to this plough is that the stilts are so long that the ploughman is too far from his cattle, but this is in a measure counterbalanced by the greater control he has over the implement. The Swedish plough No. 34 is a very useful implement and one of the best we have; it is, taking into consideration the superiority of its make, the best referred to in the statement. The single stilted plough has already been referred to, and is a very effective and handy implement. Plough No. 40 is one better adapted for use on hard or stiff soils than on soil in the condition that that in which these trials were made was. Both the Collins' ploughs were difficult to manage; both had a tendency to go downwards, and the plough marked No. 107 I. F. especially so. This being the case, the driver was unable to keep them steady and could not make a straight furrow. Although both ploughs are nearly alike, yet one required much greater draught than the other; on examining this plough it was found that the share pointed about one inch more to the landside than in the other, which most probably caused the greater draught. The ploughs are made of excellent material, but I am afraid that they cannot well be used in this country unless modified and supplied with a wheel, the draught required being too great for country cattle and the cultivators of this country not being skilled enough to work with the ploughs in their present state. The results obtained with the two American ploughs are not at all conclusive, as the ploughman using them was unaccustomed to their use, and consequently they will need further trial.

Cheaper Harrow.

87. The wooden drag harrow hitherto in use on the farm has been found very effective in reducing clods on heavy and medium soil, but it requires a rather strong pair of cattle to drag it. In order to make this kind of harrow more suited to the native cultivator a lighter one was made up on the farm: the tines, instead of being fastened to the frame with bolts and nuts, were fastened with screws, whereby the cost was considerably reduced. A harrow of the original pattern cost Rupees 25, whereas the new pattern costs only Rupees 11.

Improved Sickles.

88. During the year a number of new reaping knives of an improved pattern were made. Previously the reaping knives were made in the shape of a half circle which did not admit their being used to advantage. The pattern now adopted is that of the sickle formerly in use in England which has a strong curve immediately above the handle, but straightened out towards the point. The cost of the old pattern knives was Rupees 1-8-0 a-piece and that of the new knives is 7 annas.

The hand seed-drill referred to in paragraph 114 of last year's report has been used during the past year in sowing planks of cholum crops in several fields, and has been found to answer well for this purpose.

89. The double mhotes continue to give satisfactory results; the only drawback to them is that the repairs of the buckets, ropes, and neck-pieces are rather expensive. The same may be said of the bucket-pump, but its upkeep is more expensive than the mhote, because the repairs can only be made by a blacksmith, whereas most of the minor repairs of the mhote can be performed by any ordinary cooly.

MISCELLANEOUS.

90. *Estate.*—In April 1879 a piece of land belonging to the farm estate was transferred to the Commissariat Department on which it is intended to erect the new slaughter-yards; it measures about 23 acres and is situated near the Mount Road toll-bar about half a mile from the farm. As already noticed a considerable area of land previously unutilized was planted up with trees during the year.

91. During the year but little was done for the improvement of the estate, except in completing works already commenced. The buildings were maintained in good order, the cattle-boxes being reroofed, and such repairs as were necessary executed. The large irrigation channel dug in 1877 on the western side of the farm was brought into communication with the river by building a tunnel under the main drive at the close of the year; this work, although useful at the time as a means of affording labor in the neighbourhood, must always remain a source of expense to the farm without adequate return; a proposal made by Mr. Robertson to extend the channel to some land which could be watered by raising the water from it only a small height was negatived by Government. The main drive was stoned and regravelled throughout the greater portion of its length, the depth of metal laid down when the road was made three years ago not having been sufficient. A useful stack staddle 20 feet square supported on cast-iron pillars with a wooden frame-work was put up during the year in the stack-yard, where it has already been found most useful, and sufficient sheep hurdles were manufactured to enable us to fold our sheep in the fields for manuring purposes; the latter were made with a frame-work of flat-iron, with rejected telegraph wire stretched for intermediate bars, and are light, strong, and portable. A few other minor improvements were carried out, but nothing to need mention here.

Irrigation Channel.

Stack Staddle.

Sheep Hurdles.

92. *Live Fences.*—The plant chiefly used for this purpose on the farm is the corkapilly (*Inga dulcis*); it is a useful plant which grows very rapidly and produces ornamental and tolerably effective roadside fences. It grows so rapidly however that it requires frequent cutting to keep fences of it in order, on this farm it being trimmed about three times a year; this is naturally a source of considerable expense where, as on this farm, appearances have to be considered much, but it is to a certain extent a valuable characteristic in a hedge-plant for this country in that by growing it a large supply of firewood may be easily and cheaply raised. There is, however, one very great objection to the plant for fencing purposes, and that is the manner in which, and the area of land over which, it throws out its roots. In making some excavations during the past year the roots of a fence not three years old were traced for a distance of 24 feet on the side, and near the fence the soil was full of roots. A plant that grows so rapidly must demand a good deal of the soil, and, as this one is so vigorous and being always present, it impoverishes the soil near where it is planted to such an extent as to render the growth of a good crop on the adjoining land an almost impossible achievement.

Advantages and disadvantages of corkapilly as a hedge-plant.

93. According to the orders of Government, in Appendix IV of this report abstract statements of account are given, which I trust will be found sufficiently detailed and instructive. The accounts given are incomplete as regards the allotment of charges; for instance, it is not possible to allot the charges under live-stock fairly, as, unless a much larger accounting establishment were maintained, it could not be done; credit has been taken in this account for one-third* of the value of the artificial food consumed, which sum was debited to "manures," and the last-named account has been balanced by debiting all surplus expenditure against "crops." No credit was taken under this head for cattle-labor supplied to crops. No valuation was attempted of unexhausted meanures in the land, as we have no data for the purpose. Under labor estimated allotments have been made to crops (two-thirds), to live-stock (one-third), and to profit and loss (one-third) on account of expenditure on appearances. Under implements no credit could be taken for work performed on account of tillage operations, but the loss shown is in a great measure due to the depreciation of large numbers of useless machines transferred to the farm from time to time. No credit was taken under crops for fodder and grazing supplied to stock, it being considered as equal in value to the

Manner in which the accounts have been worked out.

* This is probably too high a valuation, but having been taken in previous years is adhered to.

manure returned. Labor, in cattle, &c., supplied to the School of Agriculture, Botanical Grounds, was not credited, but I hope will be during the current year, nor was any account taken of the manure supplied to, and produce received from, those grounds. The accounts however show generally the position of the farm financially, which has been asked for by Government.

94. There are many causes which render accounts such as these of no practical value, most of which have been explained at different times; if it be desired that absolutely accurate accounts should be kept and that the expenditure should be properly allotted under various headings, so as to bring out clearly the sources of profit or loss, the officer in charge of the farm will have to devote far more time than he should, in justice to his field-duties, to desk-work, and an increased accounting establishment must be provided. Such a state of things is highly undesirable, as already office-work takes up too much time. The cost of obtaining a complete series of accounts would far outweigh any possible practical value that can be attached to them. If Government desire the farm to be a financial success, a totally different system must be adopted; that is, as regards the objects held in view, and then, notwithstanding the unfavorable circumstances under which the farm is situated, it may be attained.

Small value of the accounts as they are.

95. *The general system of management* of the farm has been that laid down by Government in their Order, No. 1,657, dated 22nd September 1871, modified by the resolution to carry on some stock-breeding experiments on it and to suit the requirements of an educational farm as far as possible. For these purposes the land lying south of the Mylapore Tank waste water channel has been conveniently laid out and will be worked for purely experimental purposes as soon as it has been brought into a suitable state, whilst a considerable area north of the channel has been laid down in guinea grass for grazing purposes, whilst such portions of the farm as are of so inferior quality as to be only cultivable at a certain loss have been, and are being, planted out with fruit and fuel trees, for which only they are adapted.

96. I propose during the current year to set apart and work practically by itself the extreme northern portin of the farm comprising fields Nos. 29—37 inclusive and to maintain a special account of the expenditure and income therefrom; this land, though so badly situated for a commercial farm that I was obliged to report* against its being used for one, is the only portion of the estate that can be used at all for such objects, and in a modified manner it is intended to work this land as far as possible on commercial principles, but there are, as explained in paragraph 14 of this report, many causes which, setting aside the unfavorable situation of this land in particular, may prevent the work from showing a good return. I, however, hope that this may in some measure meet the views of Government in the matter.

97. Mr. Schiffmayer had charge of the details of the work connected with the farm throughout the year, and to him must be attributed such success as was attained in the growth of crops, management of stock, &c.

Regarding the subordinate establishment there is nothing to remark.

89. Holding office only as a *locum tenens*, it has been my object as far as possible to adhere to the plans which I know Mr. Robertson had in view regarding the general direction of the work of the farm. Owing to circumstances which have been detailed in previous reports, it has been impossible to do much experimental work in the field, and attention has been chiefly directed towards the amelioration of the soils of the farm, which in many cases, owing to the extensive levelling operations previously carried out, are now of most uneven quality. They naturally possess very little fertility, and are many of them in poor condition; both time and labor will be required to bring them into such a state as will admit of our engaging extensively in experimental work of scientific and practical value, but, as soon as the fields are considered to be in a suitable state, they will be devoted to such purposes. To render such work of any considerable value the aid of an Agricultural Chemist will be imperative; the services of one are also required to put the work of the School of Agriculture on a proper footing.

IMPLEMENT WORKSHOPS.

99. These shops have been a sub-division of the work carried on on the Saidápet Farm, and their object has been to supply a widely-spread want by manufacturing improved implements and tools, such as can be made use of in this country, for sale at cost price. One of the main objects of our work being the introduction and adaptation of improved implements, such an establishment is necessary. The shops were started at the beginning of 1871, but Government during the past year ordered that they should be closed, as "a manufactory for making inferior machines at Government cost is not desirable." Our experience has been that the implements, &c., made have satisfied our wants, and by a glance at the balance sheet it will be seen that these shops have cost Government during nine years the sum of Rupees 461-4-8, or about Rupees 50 per annum. During this time they have been a means of saving a large sum of

Object of the Workshops.

* See letter, No. 885, dated 22nd July 1879, printed with Board's Proceedings, No. 4269, dated 19th September 1879.

money to the Farm in the manner pointed out in the Farm Report for 1871-72, and through them the following implements, machines, &c., have been distributed to the public :—

Iron Ploughs.	American Pattern Ploughs.	Combined Ploughs.	Bullock Hoes.	Planter's Hoes.	Wheel Hoes.	Harrows of sorts.	Seed Barrow.	Carts.	Reaping Knives.	Scythes.
54	31	65	15	15	8	15	1	5	454	36

* * * * *

100. It will be necessary for us to maintain a smithery, &c., for the execution of repairs and other works for the Saidápet Farm, and I trust that Government will not object to our meeting, as far as we can, requests for the supply of such implements as we can spare.

101. In Appendix IV of this report the accounts of the shops are given.

MISCELLANEOUS WORK OF THE DEPARTMENT.

102. *Introduction and Distribution of Seeds, &c.*—Owing to the uncertainty caused by the orders of Government whether seeds should be distributed gratis or no, but little was done in this direction during the year. Towards the end of it, however, Government decided to continue the gratuitous distribution of new staples, &c., to persons interested in their introduction. The following table shows the amount of seeds sent out during the year and the districts to which they were despatched :—

Districts.	Planter's Friend.	Sorghum Saccharatum.	Cotton Seed.	Castor Beans.	Maize.	Miscellaneous. Seeds.	Models of Double Mhote.
	LB.	LB.	LB.	LB.	LB.	LB.	
1. Madras	..	..	20	20	1	..	3
2. Chingleput	3	8½	1½	..	101¼	2¾	..
3. North Arcot	50	50	..	..	..	..	..
4. South Arcot	40	40	20	..	..	..	..
5. Salem	105	150	6	..	..	4½	..
6. Trichinopoly	30	50	50	..	..	..	..
7. Coimbatore	152	210	..	..	..	20	..
8. Tanjore	..	10	..	..	..	..	..
9. Madura	50	50	..	..	..	..	..
10. Tinnevelly	100	100	..	..	..	..	..
11. Cochin	..	20	..	20	..	..	..
12. Malabar	10	10	..	..	0½	..	..
13. North Canara	125	125	..	..	..	..	..
14. Nilgiris	15	15	..	..	..	..	..
15. Bangalore	30	30	..	..	2	..	..
16. Wynaad	10	10	..	..	..	..	..
17. Bombay	2½	3½	6	2½	0½	37¾	1
18. Dharwar	20	20	..	..	..	..	..
19. Java	0½	0½	0¾	..	0½	1½	..
20. Brisbane	..	..	..	..	..	1	..
21. Sundry persons	..	2	2	..	..	..	..
Total ..	743	904¼	106¼	42½	105¾	67½	4

103. *Agricultural Exhibitions.*—None were held during the year, and up to the 1st of April no orders had been received regarding a suggestion that one should be held early in 1881; the Board of Revenue, however, had expressed an opinion that the country had still not sufficiently recovered from the effects of the famine to render it advisable to hold one then, and now it does not seem likely that one will be held.

104. On a suggestion of mine that good might be done by exhibiting some improved ploughs at work to the ryots, I despatched a party consisting of an Agricultural Instructor and two ploughmen to Trichinopoly in July. In forwarding the Instructor's report of his work to the Collector, I observed—

"The late date at which the sanction for this work was received was unfortunate for several reasons. At the time the class of students from whom I wished to select an Instructor was dispersed, and so I was not able to obtain the services of any of the best of them. The cultivating season of your district was also far advanced, and this has militated against the results of the work done.

"Of the actual results, as far as demonstrating to the ryots the superior efficiency and cheapness of these ploughs, you will be able to judge best from the reports of your revenue

officers, and I should be glad to learn what they report in this respect, as it will afford us information to guide us in future.

"The chief objections which the Instructor reports as being made by the ryots are—

(1.) The high prime cost of the ploughs.
(2.) The value of the cattle required.
(3.) The draught of the implements.
(4.) The danger of their rent being raised if, by improved cultivation, they produced larger crops.

"The only one of these objections which I think is likely to be a permanent obstacle is the first, and that I hope to be able to overcome by modifications of the plough so as to reduce its cost. We have already produced a fairly efficient plough for *light soil* at a cost of less than Rs. 10, and I do not despair of reducing its cost to Rs. 7.

"The extra risk of keeping more valuable cattle is an objection which I do not think will last. Such extra risk is accepted by the ryots of the northern districts, such as Cuddapah and Nellore, and, if stronger cattle are used, the draught of the improved ploughs will be well within their power. I saw during my tour in Trichinopoly many pairs of cattle quite competent to draw these ploughs, and they appear to have been forthcoming during the Instructor's tour on some occasions.

"The last of the objections raised by the ryots is one which must be met with in all endeavours for agricultural improvement, and can only be overcome by confirmed assurance on the part of Government to the effect that the anticipated danger is not real.

"It is incorrect, I believe, to look to the improved plough as a certain means of increasing the outturn of the crops raised. Their value lies chiefly in their superior cheapness, and efficiency in cultivating operations, and the protection obtained, by the deeper cultivation they effect, against the effects of failures of rainfall and also of excessive rainfall. Of course in many cases the deeper cultivation attained will cause a larger production. But again, in such cases as when a sour unaërated subsoil is turned up, deep ploughing may be absolutely harmful and deep cultivation needs to be carried out in such cases with great care, although its ultimate results must be beneficial.

105. As far as I am aware, the Collector had not up to the end of the year sent in any report on the work to the Board, but I cannot regard the results as otherwise than unsatisfactory, chiefly on account of the inefficiency and want of experience on the part of the Instructor sent, who however was the only man at all likely to be able to perform the work whom I could obtain, and also from the late season at which the ploughs were sent, caused by the delays which occurred in coming to a decision on the matter. I believe that great good may be done by similar exhibitions, but it is almost useless to hold them as long as no means are available for supplying such ryots with improved ploughs as would like to obtain them. As I have already pointed out, Government have stopped all manufacture for sale by this department, and as yet no other means of meeting such demands have come into existence—a regular sustained demand not having arisen.

Results unsatisfactory.

106. The annual ploughing match was held on December 19th, 1879, and was very successful. It excited a good deal of attention, especially in the case of the class in which students in the School of Agriculture were alone allowed to compete. A separate report on it was submitted and published as a supplement to the *Fort St. George Gazette* of 3rd February 1880, so it needs no further reference here.

107. *The Correspondence* with the Board of Revenue and other official bodies and with the general public on matters of agricultural interest was larger than usual during the year, but I may remark that fewer questions were referred by the Board and Government for opinion than usual, the reason for which I am not able to explain. I do not think it necessary to give lists of the chief subjects on which correspondence took place, such as have been published for the last few years, for the lists already printed are sufficient to show the general nature of our work in this direction.

108. *Publications.*—The Saidápet Farm Manual referred to at page 135 of last year's report was issued to the public in July, but, although Government had sanctioned a copy being supplied to every English-speaking Tahsildar, Deputy Tahsildar, and Revenue Inspector, this was not done, as the Board of Revenue refused to sanction a sufficient number of copies being struck off, so that only a portion of the officers named received a copy. This is greatly to be regretted, as, by giving the officers named a means of obtaining some, even if it be very little, sound information on agricultural matters, a great step forward would have been made. These officers, whose main duties are the management of the landed estates of Government, are not at present required to show any acquaintance with the first principles of rational agriculture—a state of things which might easily be obviated by insisting on their acquiring the knowledge they are deficient in before they become eligible for the posts they hold.

Value of agricultural information to Revenue officers.

109. A small Primer for the use of the Upper Primary and Middle Class Schools in the Presidency passed through the press during the year. It was prepared by Mr. Robertson and its publication was greatly delayed by that officer's absence on furlough. It has been made the text-book in the Middle School Examination.

Agricultural Primer prepared.

110. Provided that sufficient matter is available, sanction has been given for the issue in future of a half-yearly volume of records of the work of the department. This will be in a more convenient form than that adopted for the annual report, and thus it is hoped will meet with greater favor and more attention, as every one must admit that the foolscap form of publication is both cumbrous and repelling to the reader. With these records will be issued, when available, papers of interest on agricultural topics, and thus I trust they will become a valuable means of diffusing agricultural information in the country.

Issue of records.

111. *Our Agricultural Statistics*, every one must admit, are in a very unsatisfactory state, having regard to the manner in which they are prepared, and to the small importance which has until recently been attached to them; this holds good both as regards the statistics of live-stock as well as those of the areas under various crops. The only portion of them which is at all accurate is that relating to the total areas under cultivation and occupation, which clearly show how rapidly the area of available arable land is being brought under cultivation, and, when it is remembered that the land, still remaining untouched by the plough, is for the most part of very inferior quality, this fact points to the necessity for urging on efforts for the improvement of the husbandry of the Presidency in order that the land may be able to meet the demands for food and clothing which a rapidly increasing population must cause.

General inaccuracy of returns.

112. In September last, I submitted a letter to the Board of Revenue showing that, according to the statistics of live-stock, then recently published, for the period ending July 1877, by the drought and other causes the stock of the country had been reduced to almost the same number as it stood at 20 years before, as shown by the following figures in which the districts of Malabar and South Canara are excluded :—

—	1856-57, Fasli 1266.	1871-72, Fasli 1281.	1876-77, Fasli 1286.	Increase or Decrease for fifteen Years ending 1872.		Increase or Decrease for twenty Years ending 1877.	
				Total.	Percentage.	Total.	Percentage.
Tilling Cattle	2,780,385	3,563,201	3,281,396	+ 782,816	+ 28·2	+ 501,011	+ 18·0
Cows and She-buffaloes ..	3,894,068	3,363,561	3,098,102	— 530,507	— 13·6	— 795,966	— 20·4
Sheep..	6,070,651	6,696,609	6,119,390	+ 625,958	+ 10·3	+ 49,239	+ ·8
Total live-stock as Cattle ..	7,888,583	8,266,084	7,603,476	+ 377,501	+ 4·8	— 285,107	— 3·6

113. Regarding the figures, I remarked amongst other things that they showed a terrible loss of life amongst the live-stock even up to the date at which they were compiled; and I estimated the loss at about 1½ million cattle and 2 million sheep during the last five years of the period after making allowance for the births in five years, and calculated the total loss at about Rupees 2,00,00,000, and added—

"This estimate, it must be remembered, does not refer to the whole period of the famine, nor does it allow for the terrible after-effects of the scarcity in the deficiency of young stock. Want of food naturally checks the breeding of stock, and so for several seasons there can have been but few young stock raised to replace the losses. These last facts strongly point to the necessity for improving the farming of the country."

In disposing of my letter, in which I said, regarding the statistics,—

"It is not to be expected that these statistics are correct, as they are subject to no kind of check, but their inaccuracies probably balance each other at the different periods to which they refer, and so for the sake of comparison they will suffice. It may be urged that the statistics are not reliable enough to base any calculations on, but if that be the case they are worthless, and their compilation only involves a waste of time and leads to misconceptions. That there are great doubts as to the reliability of the statistics, I think I conclusively showed in paragraph 133 *et. seq.* of my Trichinopoly Tour Report, although I believe they are sufficiently accurate for comparative purposes."

The Board of Revenue remarked—

"The later figures are probably more accurate than the earlier, but until a careful census of cattle and sheep is taken nothing reliable can be deduced from them."

And added that—

"During the famine years the mortality was no doubt severe, and the Board can readily believe that correct figures would show a marked decrease in the number both of cattle and of sheep. As regards cattle, much of the loss must have been of old and useless animals, which would not have been allowed to cumber the land in any other country. As to sheep, immense numbers were killed and eaten by hunger-stricken thieves, and much larger numbers than usual must have been disposed of in supplying the markets of the famine districts. If these are added to the numbers destroyed by want of food, the figures will not warrant the conclusion that the cattle of Southern India are gradually perishing off the face of the earth, or that the country is being slowly but surely reduced to a desert."

In a further letter on the subject I suggested the advisability of taking a careful census of the cattle and sheep of the Presidency, and urged that if we once obtained accurate figures as to the number of live-stock, it would be comparatively easy to check the returns in future. The Board, and Government agreed with them, were strongly opposed to numbering the live-stock, chiefly on account of the labor of the work, and the likelihood of the measure giving rise to distrust and apprehension of increased taxation; and urged the Collectors to endeavour to attain greater accuracy in preparing future returns. * * *

114. *Prevention of Cattle disease.*—Between four and five hundred rupees were spent in the Nilgiri District for this purpose during the year, but I have no information regarding the manner in which it was spent.

115. The following publications were received in exchange for those of this department during the year:—

Proceedings of the Horticultural Society, Madras.
Journal of the Horticultural Society of India, Calcutta, 1879.
Report of the Department of Agriculture and Commerce, N.-W. Provinces and Oudh.
Report on the Government Experimental Farm, Khandeish.
Report on the Nagpore Experimental Farm.
Records of the Geological Survey of India.
Journal of the Royal Agricultural Society of England, London.
Journal of the Society of Arts, London.
Journal of the Highland and Agricultural Society of Scotland, Edinburgh.
Journal of the Royal Society, Edinburgh.
Report on the Botanical Gardens, Brisbane.
Do. do. do. Buitenzorg, Java.
Do. do. do. Ceylon.
Do. do. do. Adelaide.
Do. do. do. Melbourne.
Reports of the Commissioner of Agriculture, United States, America, 1877 and 1878.
Italian Statistical Reports.
Report on the Cultivation of Carob beans in Italy.

116. *Finances.*—The following abstract statement shows the income of the Department and the expenditure on various objects during the year; details are given in Appendix VI:—

	Rs.	A.	P.	Rs.	A.	P.		Rs.	A.	P.
Balance on the 1st April 1879 ..	..			2,29,786	0	2	*Expenditure.*			
Receipts.							General Supervision	15,577	10	1
							Saidápet Experimental Farm ..	9,835	2	3
							Implement Workshops	938	9	2
Provincial Grant	20,000	0	0				School of Agriculture	28,798	0	5
Surplus Pound Fund	44,218	15	7				Estate Improvements	3,498	13	2
Saidápet Experimental Farm ..	2,975	10	6				Compensation for killing diseased cattle in the Nilgiri District ..	456	2	10
Implement Workshops	1,236	5	4							
				68,430	15	5	Balance in favor of the Department on the 1st April 1880	2,39,112	9	8
				2,98,216	15	7		2,98,216	15	7

117. After a few weeks' privilege leave in April, I received charge of the Department from Mr. Robertson early in May when he proceeded on furlough for 19 months, and remained in that position throughout the year. The Saidápet Experimental Farm was under Mr. Schiffmayer's charge the whole year, excepting during a month that he was absent on leave in July, when, for the first time in over five years, all the work of the Department devolved on one officer. The subordinate establishment gave general satisfaction during the year.

(Signed) CHARLES BENSON, M.R.A.C.,
Ag. Superintendent, Government Farms, Madras.

SAIDAPET,
28th May 1880.

APPENDICES.

APPENDIX I.

STATEMENT showing the Monthly Rainfall compared with the Average of the previous Ten Years.

Months.	1879-80.		Average of 10 Years.	
	Rainfall.	Wet Days.	Rainfall.	Wet Days.
April 1879	..	..	·39	·7
May ,, ...	3·99	3	4·14	2·0
June ,, ...	1·81	11	2·69	5·3
July ,, ...	1·33	10	3·91	8·6
August ,, ...	7·24	15	4·76	8·6
September ,, ...	1·27	4	6·07	8·7
October ,, ...	19·13	17	10·42	10·6
November ,, ...	11·87	11	12·78	12·0
December ,, ...	5·51	7	3·67	5·2
January 1880	2·30	3	·67	1·2
February ,, ...	2·50	1	·89	·7
March ,, ...	..	..	·35	·7.
Total ..	56·95	82	50·74	64·3

Statement showing the Weekly Rainfall for 1879-80 with the Average of the previous Ten Years.

Weeks.	1879-80.		Average of the previous 10 Years.		Weeks.	1879-80.		Average of the previous 10 Years.	
	Rainfall	Wet Days.	Rainfall	Wet Days.		Rainfall	Wet Days.	Rainfall	Wet Days.
1st Week ..	..	..	·22	·2	27th Week ..	7·52	4	1·68	2·5
2nd do. ..	..	..	·01	·1	28th do. ..	2·63	3	1·40	1·7
3rd do. ..	..	..	·06	·2	29th do. ..	1·95	3	3·26	2·8
4th do. ..	..	..	·01	·1	30th do. ..	3·68	4	3·08	2·8
5th do. ..	..	..	1·42	·6	31st do. ..	3·78	6	1·96	2·2
6th do. ..	..	..	·11	·3	32nd do. ..	2·66	3	2·32	2·2
7th do. ..	..	..	1·61	·6	33rd do. ..	4·78	3	3·94	4·0
8th do. ..	3·99	3	·92	·3	34th do. ..	3·30	1	2·82	3·3
9th do. ..	..	..	·13	·3	35th do. ..	·70	1	3·28	2·5
10th do. ..	·58	4	·61	·7	36th do. ..	1·26	2	2·11	1·6
11th do. ..	·50	1	1·07	1·3	37th do. ..	..	..	1·02	1·8
12th do. ..	·05	1	·34	1·1	38th do. ..	·45	3	·46	1·0
13th do. ..	·54	5	·43	1·6	39th do. ..	3·80	2	·05	·6
14th do. ..	·19	2	·49	1·2	40th do. ..	..	..	·02	·3
15th do. ..	·02	1	·93	1·6	41st do. ..	..	..	..	..
16th do. ..	·53	3	·89	2·3	42nd do. ..	..	..	·52	·7
17th do. ..	·22	3	·74	2·1	43rd do. ..	·45	1	·14	·4
18th do. ..	·74	4	1·41	2·2	44th do. ..	1·85	2	..	..
19th do. ..	·02	1	1·31	2·6	45th do. ..	..	..	·69	·5
20th do. ..	2·77	4	1·15	1·8	46th do. ..	..	..	..	..
21st do. ..	·35	4	·84	1·8	47th do. ..	2·50	1	·12	·1
22nd do. ..	3·94	5	·96	1·6	48th do. ..	..	..	·06	·1
23rd do. ..	·70	2	1·82	2·7	49th do. ..	..	..	·15	·4
24th do. ..	·50	1	1·22	2·0	50th do. ..	..	..	..	..
25th do. ..	..	..	1·59	1·7	51st do. ..	..	..	·15	·2
26th do. ..	..	..	1·10	1·8	52nd do. ..	..	..	·05	·1

APPENDIX II-A.

STATEMENT showing the Areas cropped with and Yield of Food-grains obtained on the Saidápet Farm during the year 1879-80.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.		Remarks.
				Date of.	Seed Sown.		Date of.	Outturn.					Inches.	Wet Days.	
					Total.	Per Acre.		Grain.	Straw.	Grain per Acre.	Straw per Acre.				
	Unirrigated Cereals.		ACRES.	D. M. Y.	LB.	LB.	D. M. Y.	LB.	LB.	LB.	LB.	DAYS.			
1	Cumbu	34 I ..	1·88	24 5 79	23	12	28 7 79	302	10,164	161	5,406	65	2·53	18	Soil, sandy loam in fair condition. Followed yellow cholum fodder crop. Yield, grain low, straw good, for so short a period.
2	Do.	18 ..	2·29	22 5 79	40	17	9 8 79	140	4,940	61	2,157	79	3·44	25	
3	Do.	31 ..	1·80	11 6 79	26	14	26 8 79	466·5	9,596	259	5,331	76	5·43	27	
4	Do.	30 II ..	1·97	11 6 79	28	14	30 8 79	332	6,460	168	3,277	80	9·30	31	Soil, in bad state, containing much salt; never previously produced a fair crop, except ragi.
5	Do.	25 ..	1·91	11 6 79	20	10	30 8 79	101	3,240	53	1,696	80	9·30	31	
6	Do.	28 ..	·51	10 6 79	8	15	8 9 79	49	2,456	96	4,815	89	10·07	34	
7	Yellow cholum	11 ..	1·48	22 8 79	100	67	29 12 79	1,245	21,168	851	1,433	129	41·98	46	
8	Do.	14 ..	3·47	13 9 79	70	21	8 1 80	675	14,892	195	4,291	117	56·51	35	
9	Do.	8 ..	2·62	20 12 79	75	28	14 4 80	1,433	14,560	547	5,557	116	8·62	7	
10	Black cholum	32 ..	2·38	3 9 79	45	18	5 1 80	3,010	21,110	1,265	8,869	124	37·71	38	Soil, sandy loam of even quality. Followed horse-gram cut for fodder. Yield extremely good. Cotton sown with crop.
11	Ragi	18 ..	2·29	7 10 79	43	18	13 1 80	1,589	1,557	693	680	98	28·99	31	Ragi good as regards grain. Planter's Friend remarkable for yield of the succulent straw.
12	Planter's Friend	1 ..	1·19	1 9 79	23	19	7 1 80	700	14,308	588	12,023	129	37·78	39	
13	Do.	27 II ..	1·07	26 8 79	30	28	20 2 80	534	8,762	499	8,189	178	46·51	48	One of the worst soils on the farm. Yield fair considering the conditions. Cotton sown with crop doing fairly.
	Irrigated Cereals.														
14	Carolina paddy	37 I ..	·62	8 2 79	Planted.		6 6 79	62	1,064	100	1,716	118	6·22	9	Soil, sandy loam, fair quality, and tolerably well drained; greatest care taken with crops, but the results are all extremely unsatisfactory.
15	Do.	35 I ..	·31	11 7 79	Do.		13 10 79	75	735	24	2,371	94	19·92	34	
16	Do.	36 III ..	1·00	14 10 79	Do.		12 2 80	63	2,493	63	2,493	121	28·66	31	
17	Madagascar paddy ..	37 I ..	·31	19 7 79	Do.		22 11 79	58	780	187	2,516	136	39·54	51	Followed No. 14. Summer crop poor.
18	Do. ..	37 Ia ..	·12	25 10 79	3	25	31 3 80	163	1,741	1,358	14,508	158	25·61	26	Followed No. 14. Cold-weather crop very good.
19	Do. ..	35 II ..	·61	27 11 79	20	32	31 3 80	346	3,686	567	6,042	125	11·01	12	On same plot as crop raised last year. Outturn fair.
20	White car paddy	35 III ..	·57	31 10 79	20	35	15 3 80	279	2,185	490	3,833	136	23·23	23	Soil very inferior and situated as No. 19.
21	Do.	35 IV&V	1·14	29 11 79	60	53	24 3 80	1,960	5,880	1,719	5,158	116	11·01	12	Soil fair, but badly situated. Outturn very good.
22	Car paddy	35 I ..	·31	27 11 79	25	80	11 3 80	520	1,608	1,677	5,187	105	10·38	12	

23	Do.	37 Ib ..	·50	6 2 80	Planted.		13 4 80	666	2,022	1,332	4,044	67	2·52	2		
24	Do.	37 II ..	·45	31 12 79	Do.		29 3 80	624	2,666	1,387	5,924	90	4·80	4		
25	Do.	37 III..	·50	22 10 79	Do.		30 1 80	560	2,564	1,120	5,128	100	25·16	27	Soil previously in a very bad state ; has lately been much improved. Field is well situated for irrigation, but liable to flood. A double crop was obtained on part of the field.	
26	Do.			6 2 80			3 5 80	291	1,725	582	3,450	88	2·52	2		
27	Do.	37 IV ..	·54	21 10 79	Do.		31 3 80	360	3,440	666	6,370	102	27·26	27		
28	Do.			3 2 80			3 5 80	317	2,047	587	3,791	91	2·52	2		
29	Do.	37 V ..	·60	21 10 79	Do.		1 1 80	323	3,037	538	5,062	72	24·96	26		
30	Do.			31 1 80			30 4 80	424	1,928	707	3,213	91	2·52	2		
31	Do.	36 I ..	1·58	21 10 79	Do.		23 1 80	220	2,471	139	1,564	94	25·41	27	Soil in a bad state caused by stripping surface some years ago; drainage also bad, and out-turn consequently low.	
32	Sumba paddy (60 days) ..	36 Ib ..	1·33	29 1 80	80	60	20 4 80	451	1,913	338	1,438	82	3·37	4		
33	Car paddy	36 II ..	·37	28 11 79	Planted.		10 4 80	405	2,059	1,095	5,565	134	11.03	13	Soil in fair condition.	
34	Do.	R.F. II ..	·81	26 3 79	30	37	25 7 79	510	8,205	629	10,129	121	6·52	22	Land in river bed, south of farm buildings, situated nearly at river level; crop raised in 1879.	
35	Do.	R.F. IV..	·62	17 3 79	30	48	2 8 79	577	7,788	930	12,767	138	9·18	27		
36	Do.	R.F. VI ..	·21	11 2 79	27	128	3 6 79	55	266	262	1,267	112	6·19	7		
37	Do.	R.F. I ..	·81	6 1 80	Planted.		24 4 80	710	2,973	876	3,670	109	4·80	4		
38	Do.	R.F. II ..	·61	15 1 80	Do.		23 4 80	900	2,846	1,475	4,666	99	4·80	4	Raised on portions of the same land as the above in 1880.	
39	Do.	R.F. IV..	·79	20 1 80	Do.		24 5 80	1,280	4,744	1,620	6,005	125	4·82	5		
40	Do.	R.F. V ..	·79	6 2 80	Do.		⅔ 5 80	1,064	940	1,347	1,189	88	2·52	2		
41	Ragi	30 ..	1·00	10 11 79	20	20	28 1 80	347	2,333	347	2,333	79	14·74	13	Followed crop No. 4 on portion of field. Yield fair considering the soil.	
42	Maize	8 ..	·25	14 6 79	10	40	13 9 79	85½	4,320	342	17,280	91	10·57	35	Raised in same field as crop No. 9; cobs very small, though numerous.	
	Unirrigated Pulses.															
43	Green-gram	34 I ..	·39	29 12 79	18	46	27 3 80	43	1,349	110	3,459	94	4·80	4		
44	Do.	34 II ..	·72	22 12 79	35	48	17 3 80	209	1,691	290	2,348	86	8·60	6	Soils in nearly all cases similar and in fair condition, being a well drained sandy loam.	
45	Do.	33 ..	1·77	27 12 79	50½	29	24 3 80	490	3,542	277	2,001	88	4·80	4		
46	Do.	15 ..	2·15	31 12 79	80	37	15 4 80	108	2,804	50	1,304	106	4·80	4		
47	Black-gram	19 ..	1·39	20 12 79	59	42	8 4 80	94	1,582	67	1,138	110	8·60	6	Soil very inferior, a coarse sand in poor condition.	

APPENDIX II-B.

STATEMENT showing the Industrial Crops harvested on the Saidápet Farm during the Year 1879-80.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing. Date of	Sowing. Seed Sown. Total.	Sowing. Seed Sown. Per Acre.	Details of Harvesting. Date of	Details of Harvesting. Outturn. Total.	Details of Harvesting. Outturn. Per Acre.	Duration of Growth.	Rainfall. Inches.	Rainfall. Wet Days.	Remarks.
	Cotton.							Seed-Cotton.					
			ACRES.	D. M. Y.	LB.	LB.	D. M. Y.	LB.	LB.	DAYS.			
1	New Orleans	1	1·00	26 9 78	7	7	31 7 79	365¾	365¾	308	20·58	54	See paragraph 52 of last report. Yielded 348¼ lb. of lint = 31·7 per cent.
2	Do.	3	1·78	28 9 78	20	11	Do.	733½	412	306	20·33	53	
3	Do.	4 II ..	3·18	12 9 78	25	8	10 7 79	1,810¼	569	301	20·24	51	See paragraph 91 of last report. Yielded 574½ lb. of lint = 31·7 per cent.
	Oil Seeds.							Seed.					
								LB.	LB.				
4	Castor beans	26 II ..	1·22	2 12 78	25	20	9 7 79	53½	44	219	9·14	29	Raised amongst casuarina trees for shade, but owing to extreme drought did badly.
5	Do.	24 II ..	1·20	11 12 78	31	26	20 6 79	152½	127	191	9·29	19	
6	Do.	12 I and II.	·40	28 12 78	Sorts.		2 8 79	324½	811	217	9·90	31	This was of several varieties raised from Italian seeds.
7	Gingelly	10	4·25	1 5 79	80	19	9 8 79	321	75	81	7·34	26	Soil, sandy loam; crop suffered from bad weather and also in harvesting.
8	Do.	15	7·30	21 5 79	41	5	9 8 79	176½	24	80	7·34	26	
9	Do.	29	4·26	10 6 79	43½	10	30 8 79	340	80	81	9·30	31	
10	Do.	35 IV ..	·35	27 5 79	11	31	6 9 79	50½	144	102	10·45	37	Land is ordinary paddy land, nearly all a sandy loam; the crop suffered like those above. See crops Nos. 14, 15 and 16, Table A.
11	Do.	35 II ..	·61	27 5 79	14	23	25 8 79	42	69	90	6·45	31	
12	Do.	35 VII ..	·71	Do.	14	20	15 8 79	61	86	80	4·64	25	
13	Do.	36 I ..	1·58	Do.	15	10	24 8 79	50	32	89	6·45	31	
14	Do.	37	2·23	10 6 79	20	9	30 8 79	250	112	81	9·30	31	
15	Do.	10 I ..	1·16	6 1 80	33	28	7 4 80	130	112	92	4·80	4	Raised as a late cold-weather crop in alternate double lines with gram; the yield in some cases was very good, and considering the circumstances, the whole was fair.
16	Do.	15 I ..	2·15	6 1 80	60	28	31 3 80	504	238	85	4·80	4	
17	Do.	21	1·58	27 12 79	50	31	2 4 80	155	98	97	4·80	4	
18	Do.	33	1·77	27 12 79	45	25	25 3 80	304	172	89	10·31	11	
19	Do.	34 I ..	·38	29 12 79	18	48	7 4 80	194	511	100	4·80	4	
20	Do.	34 II ..	·72	22 12 79	35	48	7 4 80	145	201	109	8·60	6	
							3 cuttings up to	Bundles.					
21	Indigo	14	3·47	5 12 78	80	23	14 6 79	206½	60	191	8·26	19	See paragraph 53 of last report. Seed sown under unfavorable conditions, and outturn very low.
22	Do.	11	1·48	15 2 79	35	23	16 6 79	78½	53	121	7·17	12	Crops sown late, and, although irrigated occasionally, the yield is very low.
23	Do.	13	1·36	14 1 79	80	58	13 6 79	71	52	150	8·17	20	
24	Do.	20	1·48	19 2 79	9	6	27 6 79	48	32	128	7·57	16	
25	Do.	35 III ..	·57	22 2 79	6	10	18 6 79	26½	46	116	7·17	12	Raised in a paddy field of very inferior character and unfavorably situated; occasionally irrigated.
								Seed.					
								LB.	LB.				
26	Do.	22	·27	24 2 79	4	15	30 9 79	31	115	218	17·69	47	Raised under similar conditions to crops Nos. 22—24.
27	Do.	34 I ..	·77	1 2 79	12	15	20 9 79	60	78	232	17·69	47	The plants in this case were very fine, weighing, when cut, at the rate of 7,272 lb. per acre, but the pods were badly filled.
28	Do.	10 II ..	1·93	23 8 79	10	6	18 1 80	738	382	148	41·93	35	A magnificent crop, grown on a fair soil, in good condition.
								Dry leaf.					
								LB.	LB.				
29	Tobacco	8	·50	19 12 78	Planted		3 3 79	828	1,656	74	1·05	6	See parapraphs 79—82 of last report.
30	Do.	4	·50	4 12 79	Do.		26 3 80	*500	1,000	113	10·31	11	Raised without irrigation on a piece of fair soil.

* Estimated, part not yet stripped.

APPENDIX II-C.

STATEMENT showing Fodder Crops harvested during 1879-80 on the Saidápet Experimental Farm.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.			Duration of Growth.	Rainfall.		Remarks.
				Date of	Seed Sown. Total.	Seed Sown. Per Acre.	Date of.	Outturn of Fodder. Total.	Outturn of Fodder. Per Acre.		Inches.	Wet Days.	
	Irrigated Cereal.		ACRES.	D. M. Y.	LB.	LB.	D. M. Y.	LB.	LB.	DAYS.			
1	Yellow cholum	4 III ..	2·35	28 3 79	80	34	26 7 79	16,246	6,900	120	6·52	21	Soil of plot irregular; outturn, considering the season and soil, fair.
2	Do.	35 I & IX ..	·51	24 3 79	8	15	18 6 79	2,668	5,241	86	5·12	9	A paddy field, in tolerably good condition.
3	Do.	36 II & III..	1·37	22 3 79	30	22	15 9 79	15,240	11,124	177	16·14	44	A paddy field, produced crops Nos. 16 and 33 in Table A. Crop very fine under circumstances.
4	Sorghum	23 II ..	1·5	22 3 79	50	33	19 6 79	12,468	8,312	89	5·62	10	Soil, sandy loam in good condition. First successful crop of sort grown in the hot weather.
	Unirrigated Cereal.												
5	Maize	16 ..	2·41	11 10 79	52½	21	29 11 79	3,569	1,481	49	21·23	22	Crop sown for grain, but failed and cut as fodder.
6	Cumbu	17 ..	4·90	28 10 79	42½	8	16 12 79	1,456	297	49	16·54	16	Soil generally the poorest and worst on the farm. Crop removed and land resown with a very successful crop, not harvested.
7	Do.	33 ..	3·54	24 5 79	78	22	26 7 79	13,580	3,815	62	2·53	18	Followed No. 19. Outturn fair considering circumstances.
8	White cholum	31 ..	1·80	9 10 79	50	28	22 11 79	2,412	1,340	44	20·69	22	
9	Do.	34 II ..	1·58	28 10 79	33	21	22 12 79	1,456	921	55	16·93	19	
10	Yellow cholum	33 ..	3·54	17 10 79	87	24	26 12 79	4,928	1,392	70	22·36	28	Followed No. 7. Sown as grain crop, but failed and cut as fodder.
11	Sorghum	35 VI ..	·71	29 11 79	20	28	9 2 80	4,720	6,648	72	8·51	10	
12	Do.	4 ..	·94	13 12 79	33	35	6 4 80	4,316	4,591	115	9·05	9	
	Unirrigated Leguminous.												
13	Horse-gram	17 ..	4·90	22 3 79	82	16	11 10 79	58,510	11,953	143	24·85	48	Same field as No. 6, harvested partially dry. Outturn very good.
14	Do.	29 I ..	4·26	6 1 79	98	23	6 6 79	13,460	3,154	151	6·89	12	Soil fair quality, but in low condition; difficult of access and remote from buildings.
15	Do.	37 II ..	·45	11 2 79	10	22	6 6 79	1,284	2,853	112	6·22	9	Grown on a paddy field—See crop Nos. 24—30 in Table A. Very satisfactory.
16	Do.	37 III, IV, & V .. .	1·78	21 1 79	53	29	13 6 79	13,104	7,362	143	7·84	15	
17	Do.	32 ..	4·76	27 5 79	82	27	9 8 79	9,876	2,074	74	3·39	24	Preceded crop No. 10, Statement A.
18	Do.	18 ..	2·30	22 5 79	40	17	9 8 79	11,420	4,965	79	3·44	25	
19	Do.	33 ..	3·54	16 1 79	100	28	10 5 79	11,320	3,198	114	2·37	5	
20	Horse-gram and cumbu ..	21 ..	6·07	20 8 79	100	16	30 11 79	23,090	3,804	102	36·49	40	Soil very poor but much improved by ploughing in previous crop.
21	Do. do. ..	14 ..	3·47	10 1 80	75	21	5 4 80	7,168	2,065	86	4·80	4	Followed crop No. 8, Statement A. Outturn recorded is weight of hay.
22	Dew-gram	21 ..	1·58	27 12 79	50½	32	6 4 80	26,470	16,753	101	4·80	4	Followed No. 20. Sown with crop No. 17, Statement B: return very good.
23	Do.	10 ..	1·09	6 1 80	60	55	17 4 80	3,544	3,251	102	4·80	4	Sown with crop No. 15, Statement B; half-dried when weighed.

APPENDIX III.

STATEMENT showing the number of Stock maintained during the Year 1879-80.

—	1879. April.	May.	June.	July.	August.	September.	October.	November.	December.	1880. January.	February.	March.	Average.
Cattle	37	36	36	34	35	35	34	39	39	42	42	43	38
Sheep	268	261	259	249	252	250	246	235	231	245	254	262	251
Pigs	14	11	4	4	4	4	4	4	4	4	7	7	6
Equivalent as country cattle 300 lb. live weight	130	129	126	120	122	122	119	127	126	129	126	131	125

VALUATION of Artificial Food supplied to Stock during the year 1879-80.

—	Working Cattle.		Cows and their Calves.		Sheep.		Pigs.		Amount supplied.	Value.
	Amount.	Value.	Amount.	Value.	Amount.	Value.	Amount.	Value.		
	LB.	RS. A. P.	LB.	RS. A. P.	LB.	RS. A. P.	LB.	RS. A. P.	LB.	RS. A. P.
Ground-nut Cake	36,415	639 14 9	2,196	37 14 2	44,563	769 0 0	3,596	62 7 11	86,770	1,509 4 10
Bran	..	..	1,814	36 4 5	1,083	21 10 7	24	0 7 6	2,921	58 6 6
Tour	..	..	1,333	9 8 4	350	2 8 0	114	0 13 0	1,797	12 13 4
Salt	363	13 0 9	90¾	3 4 4	544½	19 9 1	90¾	3 4 4	1,089	39 2 6
Grains	1,639	33 13 11	278	7 8 11	1,615	42 1 0	81	1 6 5	3,613	84 14 3
Total ..	..	686 13 5	..	94 8 2	..	854 12 8	..	68 7 2	..	1,704 9 5
Deduct one-third charged to manure	..	228 15 2	..	*	..	284 14 11	..	22 13 1	..	568 3 2
Net charge ..	..	457 14 3	..	94 8 2	..	569 13 9	..	45 10 1	..	1,136 6 3
Cost per head per mensem	..	1 4 6	..	2 10 0	..	0 3 0	..	0 10 2	..	0 12 1†

* No deduction made, as cows were giving milk.

† Calculated on total stock, reduced to country cattle of 300 lb. live weight.

APPENDIX IV.

STATEMENT of the Accounts of the Saidápet Experimental Farm for the Year 1879-80.

BALANCE SHEET, 31st MARCH 1880.

Liabilities—	RS.	A.	P.	*Assets*—	RS.	A.	P.
Capital	24,433	7	7	Valuation as per statement.	24,461	12	3
Due sundry persons ...	369	6	4	Due by sundry persons ...	341	1	8
	24,802	13	11		24,802	13	11

CASH ACCOUNT FOR THE YEAR 1879-80.

Receipts—	RS.	A.	P.	*Expenditure*—	RS.	A.	P.
Capital advanced by Government	6,859	7	9	Live-stock...	2,177	0	7
Live stock	800	0	11	Grains	412	4	6
Grains	578	9	6	Manures	523	10	2
Implements	278	1	3	Implements	1,095	1	2
Fruits	715	12	10	Sundries	367	13	7
Sundries	603	2	0	Labor	3,421	10	2
				Establishment	1,582	9	11
				Despatching seeds ...	255	0	2
	9,835	2	3		9,835	2	3

PROFIT AND LOSS ACCOUNT.

	RS.	A.	P.		RS.	A.	P.
Establishment	1,580	9	11	Crops	2,277	7	2
Bad debt	4	8	0	Sundries	252	1	9
Despatching seeds	255	0	2	Capital* for balance	2,318	9	5
Implements and machines ...	807	15	9				
Labor	552	2	11				
Live-stock	1,647	13	7				
	4,848	2	4		4,848	2	4

Valuation of the Saidápet Farm and Estate made on the 31st March 1880, compared with that made on the 31st March 1879.

—	Valuation of Stock on the 31st March 1879.			Increase in the Year.			Decrease in the Year.			Valuation of Stock on the 31st March 1880.		
Farm.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Live-stock, viz.—												
Cattle	1,660	0	0	200	0	0	..			1,860	0	0
Sheep†	1,180	0	0	..			347	0	0	833	0	0
Pigs	140	0	0	25	0	0	..			165	0	0
Poultry	135	0	0	27	8	0	..			162	8	0
Cattle food, &c.‡	1,036	0	0	..			194	9	0	197	8	0
Grains, &c.										643	15	0
Manures	225	0	0	5	0	0	..			230	0	0
Implements§	6,238	0	0	..			369	2	9	5,868	13	3
Crops, viz.—												
Ordinary crops	780	0	0	607	0	0	..			1,387	0	0
Fruit and fuel trees	9,000	0	0	4,114	0	0	..			13,114	0	0
	20,394	0	0	4,067	12	3	..			24,461	12	3
Estate.												
Land‖	37,800	0	0	..			1,300	0	0	36,500	0	0
Buildings	21,900	0	0	100	0	0	..			22,000	0	0
Wells and Channels	7,000	0	0	200	0	0	..			7,200	0	0
	66,700	0	0	..			1,000	0	0	65,700	0	0

* This is the sum which the Farm cost to Government during the year.
† Decrease due to the distribution of 39 rams gratis and losses by disease.
‡ Included with grains last year.
§ Decrease due to sales and deterioration of old machines.
‖ Decrease due to diminished area of estate.

APPENDIX V.

STATEMENT of Accounts of the Implement Workshops for the Year ending 31st of March 1880.

Income.	RS. A. P.	Expenditure.	RS. A. P.
Machines	273 8 7	Carpenter, Smith, and Filer	371 0 3
Materials	421 7 10	Cooly labor	110 2 8
Labor	541 4 11	Machines, &c.	457 6 3
		Capital repaid during the year	297 12 2
Total ..	1,236 5 4	Total ..	1,236 5 4

Balance Sheet on the 31st March 1880.

Liabilities.	RS. A. P.	RS. A. P.	*Assets.*	RS. A. P.	RS. A. P.
			Valuation—		
Capital invested on 1st April 1879	1,851 11 10		Buildings	431 0 0	
			Plant	193 9 0	
Capital repaid during the year ending 31st March 1880 ..	297 12 2		Implements on sale ..	287 8 0	
					912 1 0
		1,553 15 8	Outstanding bills ..	..	180 10 0
			Deficiency, *i.e.*, loss since starting..	..	461 4 8
Total ..		1,553 15 8	Total ..		1,553 15 8

APPENDIX VI.

STATEMENT of the Accounts of the Madras Agricultural Department for the Year 1879-80.

Expenditure—	RS. A. P.	RS. A. P.
I. General Supervision—		
Establishment...	13,727 9 5*	
Travelling Charges	559 5 5	
Exhibition of improved ploughs	420 9 10	
Ploughing competition	210 1 6	
Contingencies	419 15 11	
Surgeon for Medical charge...	240 0 0	
		15,577 10 1
II. Saidápet Experimental Farm as detailed in Appendix IV	...	9,835 2 3
III. Implement Workshops as per statement given in Appendix V	...	938 9 2
IV. Educational (School of Agriculture)—		
Establishment	4,030 2 4	
Stipends and Scholarships	4,927 8 0	
Lecture Fees	5,840 0 0	
Contingent Charges	1,697 15 10	
Botanical Garden	765 6 3	17,261 0 5
Constructing School of Agriculture	10,200 0 0	
Constructing Veterinary Hospital	1,337 0 0	
		11,537 0 0
V. Estate Charges and Improvements—		
Repairs to buildings	996 12 1	
Trees and planting	318 11 1	
Manufacture of drain pipes and subsoil drainage ...	91 3 9	
Brick and mortar bridges under main roads ...	544 0 4	
Extension to water channels	391 8 6	
Repairs to roads	369 10 1	
Sundry works and alterations	323 1 7	
Stack staddle and sheep hurdles	452 15 5	
Maintenance to Superintendent's Quarters ...	10 14 4	
		3,498 13 2
VI. Other Charges—		
Compensation for killing diseased cattle in the Nílgiri District	...	456 2 10
		59,104 5 11

* Does not include any furlough allowances paid to Mr. Robertson, as they have not yet been adjusted.

	Rs.	A.	P.	Rs.	A.	P.
Adjusted balance at the beginning of the year ...	2,29,786	0	2			
Income—						
Provincial Grant	20,000	0	0			
Receipts from the Surplus Pound Fund during the year 1879-80	44,218	15	7			
Saidápet Experimental Farm as per statement given in Appendix	2,975	10	6			
Implement Workshops	1,236	5	4			
				2,98,216	15	7
Balance in favor of the department on the 1st of April 1880 ...				2,39,112	9	8

Resolution—

With the foregoing letter the Superintendent of Government Farms submits his report for the year 1879-80, which will be forwarded to Government. The Board observe that the report is unnecessarily diffuse and contains a considerable quantity of matter which would have been better omitted.

2. The season was on the whole a good one, the rainfall (about fifty-seven inches) being considerably in excess of the average at Madras. The fall was distributed over ten months of the year. The experiment in subsoil drainage was not altogether successful, and a renewed effort is to be made on another plot of land. In certain parts of the Farm crops were sown in rotation, but, owing to unexpected changes of weather, the results were of no great value. Good crops were obtained of Black Cholum (*Sorghum saccharatum*) and of Planter's Friend (*Sorghum Kaffrarium*). The seed of the former crop was obtained from Trichinopoly, and Mr. Benson is doubtful regarding its sugar-producing qualities. Carolina rice failed as usual, but Madagascar paddy gave better results than formerly. Further information is promised regarding certain experiments in the cultivation of tobacco and of Manilla hemp (*Musa textilis*). The results of the experiments regarding cattle manure, referred to in paragraph 74, will doubtless prove instructive.

3. Under the heading *Live-stock* an account is given of an outbreak of disease amongst the sheep of the Farm which was productive of great loss; otherwise the report regarding the live-stock is satisfactory.

4. Speaking of accounts, Mr. Benson deprecates attempts being made at absolute accuracy in apportioning charges and says that the utility of accounts systematically drawn up would be small compared with the labor involved in their preparation. He trusts that Appendix IV will afford sufficient information. It contains two statements —one the account of receipts and expenditure, &c., and one of valuation of the property at the close of the year. The total expenditure of the year under the several heads—I, General Supervision; II, Experimental Farm; III, Workshop; IV, School of Agriculture; V and VI, Estate and Other Charges—amounted to Rs. 59,104-5-11, but the sum is exclusive of Mr. Robertson's furlough allowance, which has yet to be adjusted.

5. Referring to paragraphs 13, 14, and 96, the Board would still insist upon the maintenance of a Model Farm as distinguished from the Experimental Farm. The financial results which can be obtained constitute a crucial test of the value of improved methods of agriculture, and satisfactory results ought to be constantly kept in view.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

Order thereon, ———— 18th May 1881, No. 785, Revenue.

* * * *

4. The Government will note briefly such points as still call for remark. A summary of the paper has already been given in the Presidency Administration Report for 1879-80.

5. As agricultural education is dealt with separately, this subject might have been noticed more briefly.

6. One agricultural tour only was made during the year by any officer of the department. The attention of the Board has already been drawn to the advisability of such tours being undertaken as frequently as possible.

7. In the Saidápet Farm the year was more favorable to the growth of fodder than grain crops, though with the early-sown crops the yield of grain was heavier than that obtained in previous years.

8. The result of further experiments in the cultivation of Black Cholum (*Sorghum saccharatum*) will be awaited to determine its resemblance to the Chinese sugar-cane as to sugar-producing qualities.

9. Experiments in cotton cultivation are watched with interest, and it is observed that the outturn of New Orleans was satisfactory.

10. Under the head of Implements considerable attention was paid to the comparative efficiency of the different ploughs in use in Europe and America when applied under various conditions to native soils. The Swedish plough still stands high in favor in localities where the soil is dry and deep ploughing is required.

11. In paragraph 98 of the report the Acting Superintendent alludes to the necessity of engaging the services of an Agricultural Chemist. Mr. Robertson, who has now returned from leave, will no doubt submit a more detailed recommendation on the subject on the educational side.

12. The application for sanction for maintaining a Smithy establishment mentioned in paragraph 100 is also out of place in an annual report and should be separately brought forward. The objection as to supplying ploughs, &c., has been withdrawn.*

* G.O., dated 14th January 1881, No. 111.

13. While concurring with the Board in the views expressed in paragraph 5 of their Proceedings, the Government are of opinion that no very reliable deductions can be expected unless comparisons are made with results obtained under other conditions of soil, climate, rainfall, &c., in dissimilar districts, which the extension of Model Farms will alone admit of.

14. The report bears evidence to the zeal evinced by the officers of the department during the year, and satisfactory results were, on the whole, obtained.

15. Paragraphs 4 to 14 of this Order will be published with the revised report and the Board's review for general information.

(True Extract.)

(Signed) E. N. OVERBURY,
Acting Under Secy. to Govt.

To the Board of Revenue.
„ the Educational Department.

Resolution—

COMMUNICATED to all Officers in correspondence with the Board.

2. The reports from the Superintendent of Government Farms which come through the Board will in future be submitted by the Board as Board's Proceedings.

It is requested that the necessary correction may be made in G.O., dated 30th April 1879, No. 663, Public, Appendix B, Column 6.

(A true Copy and Extract.)

(Signed) C. D. MACLEAN,
Acting Sub-Secretary.

(True Copy.)

(Signed) S. SRINIVASA RAGHAVAIYANGAR,
First Assistant.

To all Officers in correspondence with the Board.
„ the Secretary to Government, Revenue Department.
„ the Chief Secretary to Government, Public Department.
„ the Superintendent of Government Farms.

Exd. A. S. Rodgers, J. W. Fischer, and W. J. Lewis.

1881.

Board of Revenue,

MADRAS.

To

ALL OFFICERS IN
CORRESPONDENCE WITH
THE BOARD,
&c., &c., &c.

Printed October 17th.

Received

PROCEEDINGS, 10TH OCT. 1881, No. 1935.

COMMUNICATING to all Officers in correspondence with the Board Government Order on the Annual Report of the *Madras Agricultural Department*, and stating that the reports from the Superintendent, Government Farms, which come through the Board will in future be submitted by the Board as Board's Proceedings.

7TH SEPTEMBER 1882, No. 958, REVENUE.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ—the following Proceedings of the Board of Revenue, dated 8th August 1882, No. 1962 :—

Read—the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to the Secretary to the Board of Revenue, dated Saidápet, 14th July 1882, No. 1024 :—

I have the honor to submit the report of the Saidápet Farm for the official year ending the 31st of March last. The General Report is nearly ready for the printer, and will, I trust, be submitted before the close of the present month.

2. I shall feel much obliged if I may be permitted to distribute this report *at once* along with those of the previous two years, which reports have not yet been given to the public. I make this request, in view to the holding of an Agricultural Exhibition in Madras in February next, as some of the points raised in these reports may suggest inquiry, and possibly some of the experiments may be repeated and followed up, the results being utilized either in the essays and reports to be invited in competition for prizes, or in any discussions that may be held at the Agricultural Conference. These reports, it must be remembered, are the only agricultural publications issued in South India.

3. I would point out that the Cawnpore Farm Reports are issued at once, without waiting for review by the controlling authority—a course which is highly advantageous to the interests of the Farm, especially in maintaining public interest in its work.

4. I have quoted briefly in the report from two or three papers I have submitted to the Board during the year. This course was necessary to show the work of the year and to connect together the results in a way to make them intelligible to persons interested and desirous of carrying out the inquiries further.

ENCLOSURE.

REPORT on the Saidápet Experimental Farm and Experimental Grounds, for the year ending 31st March 1882.

This report deals only with the operations conducted on the Farm, and Experimental Grounds; the general work of the Department, and that of the School of Agriculture, are as usual reported on in separate reports.

2. SEASON.—The weather was so unfavorable in May, June and July that no hot-weather crops were sown. The total rainfall from the 1st of April to the 31st of July, 121 days, amounted only to 2·18 inches, and as it fell in very slight showers, it

scarcely had any appreciable effect on the scorched land, while as the temperature in the shade ranged between 95 and 105°, all vegetable growth was stopped excepting on irrigated land, or under very exceptional circumstances. A heavy shower fell on the last day of July. In August, the weather was more favorable for farming operations, not for getting in crops, but for preparing the land for the cold-weather sowings. Favorable weather in this month facilitates greatly the putting in of the cold-weather crop, when the right time comes for this, for as the sowing season is usually such a very short one, the work has to be done with great expedition, thus there is but seldom then an opportunity for working and cleaning the land. In September, the weather was seasonable, the rainfall being slightly above the average. Advantage was taken of these favorable conditions to get a considerable area of land sown, the chief of these crops being maize, cotton, and sorghum of different varieties. In October, the weather was highly unfavorable to the young crops sown in the previous month. From the 5th to the end of the month there was only one slight shower, ·05 of an inch, while the total fall of the month was less than 3 inches. The average fall in this month is, 12 inches. The drought, of course, checked the growth of young plants, while those more advanced were, under the same influences, prematurely brought into flower. The rainfall in November was above the average; there were several heavy falls in this month which did considerable damage, notably the fall on the 13th, which amounted to 6·80 inches, and the fall on the 20th, 3·40 inches. Young crops sown in October benefited from the wetness of the month, but those more advanced, especially those that were in flower at the beginning of the month and which came into flower during the month, suffered seriously, chiefly from the fertilization processes being interrupted and impeded, by the pollen being washed off the flowers; and crops which gave great promise in the early part of October, yielded fully 30 per cent. less than otherwise they would have done, the grain at harvest having been found small and shrivelled, and very light in weight. It is to be feared this experience will have been very common in this locality, where, from the favorable weather in August and September, a considerable breadth of crop was sown early, which, consequently, was in an advanced state when the heavy rains of November occurred. The fact, that a wet blossoming season, is invariably followed by a poor outturn at harvest, is well known in most countries.

3. The storm which broke over the district on the 12th of November did great damage on the Farm, especially to plantain topes and the more advanced crops, a considerable area having been prostrated by the violence of the storm. The rain, however, contributed towards filling the tanks, which up to this period had remained almost dry. Nothing could previously be done in getting in paddy or other crops, needing frequent irrigation. The rainfall in December was higher than the average, but it was very unevenly distributed. There were showers on each of the first three days in January; but, no more rain fell up to the close of the year; however, during these three months, the weather was unusually cloudy, and the range of temperature low. In the mornings, fogs were experienced almost daily, from the beginning of January up until about the middle of March. They were unusually dense, and continued frequently up to as late in the day as 8 A. M. In no previous year, in the past 13 years, has there been at Saidápet, such an amount of fog as, was experienced in the months under notice. The fogs thus contributed, to a certain extent, to make up for the deficiency of the rainfall; for, on most of the mornings every tree, shrub, and plant, was so heavily laden with moisture that the slightest movement sufficed to precipitate much of it on the ground, and, of course, during the prevalence of such fogs, when the atmosphere is saturated with moisture, plants dissipate but small quantities of water into the air, and therefore need less water. It is to be regretted that there are no convenient means, by which the quantity of water condensed by plants, and soils from fogs and dews, can readily be determined. The quantity of water thus supplied, must be very considerable in some localities, and must compensate, to no inconsiderable extent, for a small rain supply.

4. The following statement exhibits the daily registrations of the rainfall throughout the year. It will be observed that the distribution of the fall was, as usual, very

irregular; while, the total fall was only 44·28 inches, that is, about 8 inches less than the average annual fall, in the previous ten years :—

STATEMENT showing the Daily Registration of Rainfall for 1881-82.

Date.	1881.									1882.		
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.
1 ..	..	..	..	..	..	·20	..	·10	..	·25	..	..
2 ..	..	..	·10	..	..	1·36	1·75	·40	..	·12	..	..
3 ..	..	..	..	..	..	..	..	·15	..	·20	..	..
4 ..	..	..	..	..	..	..	·05	·30	..	..	..	..
5 ..	..	..	..	..	..	..	1·00	1·10	..	..	..	..
6 ..	..	..	..	..	·07	..	..	..	..	..	..	..
7 ..	..	..	·05	..	·35	..	..	·30	..	..	..	..
8 ..	..	..	..	..	2·95	..	..	·95	..	..	..	..
9 ..	..	..	·31	..	·14	·50	..	·90	..	..	..	..
10 ..	..	..	..	·15	..	·10	..	·01	·80	..	..	..
11 ..	..	..	..	..	..	..	..	..	·13	..	..	..
12 ..	..	..	·05	..	·30	..	..	1·60	·80	..	..	..
13 ..	..	..	..	·09	..	·20	..	6·80	..	..	..	..
14 ..	..	..	..	·05	..	..	..	·35	..	..	..	..
15 ..	..	..	..	..	..	·18	..	·20	..	..	..	..
16 ..	..	..	..	..	..	..	..	..	..	..	..	..
17 ..	..	..	..	..	..	..	..	..	..	..	..	..
18 ..	..	..	..	..	..	3·65	..	..	..	..	..	..
19 ..	..	..	..	..	..	·45	..	..	..	..	..	..
20 ..	..	..	·47	..	..	·35	..	3·40	..	..	..	..
21 ..	..	..	..	..	·15	·05	..	..	..	..	..	..
22 ..	..	..	..	·75	·30	..	..	·25	·95	..	..	..
23 ..	..	..	..	..	..	·90	..	..	..	..	..	..
24 ..	..	..	..	..	..	..	..	..	..	..	..	..
25 ..	..	·14	..	..	·65	..	..	..	..	..	..	..
26 ..	..	..	·02	..	..	..	·05	..	..	..	..	..
27 ..	..	..	..	..	..	..	..	..	..	..	..	..
28 ..	..	..	..	..	..	..	..	..	..	..	..	..
29 ..	..	..	..	..	..	..	..	..	·80	..	..	..
30 ..	..	..	..	..	·38	·01	..	·05	1·85	..	..	..
31 ..	..	..	..	2·15	..	..	..	..	1·10	..	..	..
Total ..	..	·14	1·00	3·19	5·29	7·95	2·85	16·86	6·43	·57	..	..

Further detailed statements of rainfall, will be found in the appendix.

CROPS.

5. The early-sown crops were generally free from "fungoid" diseases, but the later crops were, in several instances, severely attacked by "rust," the result chiefly of the bad climatical conditions, which characterized the latter portion of the cold weather cropping season.

6. Neither "smut" nor "ergot" were observed on the crops. This, probably, was due to the fact that the seeds were, in almost every instance, dressed with sulphate of copper, before being sown. The process followed, is shown in the following directions :—

"For 50 lb. of seed, take 3 ounces of sulphate of copper, which dissolve in one quart of hot water; when the solution is quite cold, pour it over the seed, and mix thoroughly; when quite dry, the seed is fit for sowing."

The object in dressing the seed in this way, is to kill the fungoid spores that may be mingled with the seed; this dressing, however, does not appear to have any marked effect in preventing attacks by "rust." Of course, if straw is used, in bedding the cattle, which has been attacked by fungoid disease, and the manure of which this bedding forms a part, is applied to land, the probability is that the spores of the fungus will be conveyed to the soil at the same time, and in this way the spores may get into the plants, even though the seed, from which they were raised, was chemically prepared. There is, however, one clear advantage in thus dressing the seed, irrespective of any effect that may be produced in checking fungoid disease; this is, in

preventing the coolies from eating the grain when they are sowing it. In other countries the loss, in this way, is too trivial for attention, but in this country, where four or five men are usually employed to do work for which in other countries one man would be employed, and where, the people are grain-feeders, and frequently only half-fed, the consumption of grain during the sowing process is often a most serious evil; not so much on account of the value of the grain as, because the land is frequently only half-seeded—a fact which is disclosed only, when it is *too late* to remedy the evil.

7. The paddy crops of the farm were attacked by a fungoid disease, and afterwards by insects. The cause was the mismanagement of the irrigation water, it having been allowed to stagnate, by too long retention on the land. By draining off the water, and drying the land for a few days, the crops recovered completely from both attacks.

8. The total area under crops was 150·12 acres; of this 22·49 acres were under crop which stood throughout the year; and 8·62 acres of crops were used as green manure.

FODDER CROPS.

9. Fodder crops were raised on an area of 34·01 acres, of which 8·21 acres were sown before the commencement of the year, and 25·80 acres were standing at the close of the year. Besides the crops recorded, 22·05 acres were under old guinea grass, and hariali grass, throughout the whole year, and afforded pasturage for the stock.

10. The next statement shows the fodder crops harvested in the year:—

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.			Duration of Growth.	Rainfall.	
				Date of	Seed sown.		Date of harvesting.	Outturn.			Inches.	Wet Days.
					Total.	Per Acre.		Fodder.	Per Acre.			
			ACRES.					LB.	LB.	DAYS.		
1	Guinea Grass	I-A.B. ..	2·38	6th October 1881	Planted.		7th February 1882	8,571	3,601	124	23·91	27
2	Do.	3 ..	1·78	8th November 1881	Do.		18th March 1882	8,941	5,023	130	21·51	20
3	Do.	16 ..	4·82	30th November 1880	Do.		19th December 1881	16,530	3,429	384	47·07	68
4	Do.	27-B ..	2·05	9th November 1881	Do.		9th February 1882	1,515	739	85	20·56	19
5	Cumboo	4-A ..	·60	6th August 1881	5	8·3	11th October 1881	3,510	5,850	66	16·04	24
6	Yellow Cholum	4-C ..	·60	6th August 1881	16	26·6	16th December 1881	11,516	19,193	132	34·68	44
7	Planter's Friend	4 ..	·50	2nd August 1881	..	..	13th September 1881 to 22nd October 1881.	1,185	2,370	42	16·04	24
8	Yellow Cholum	20 ..	1·48	28th February 1881	67½	45·6	7th July 1881	3,385	2,287	129	1·14	7
9	Planter's Friend	12-A ..	·82	12th April 1881	20	24·4	9th August 1881	2,732	3,332	89	7·84	16
10	Do.	14 ..	3·47	10th November 1881	147	42·3	5th January 1882	10,961	3,159	81	19·66	18
11	Do.	35-II ..	·62	3rd May 1881	12	19	29th August 1881	1,015	1,637	118	9·24	20
12	Sugar-cane	35-II ..	·62	28th September 1880	Planted.		18th November 1881	1,570	2,532	416	71·40	103
13	Horse-gram	14 ..	3·47	1st August 1881	70	20	26th September 1881	6,808	1,962	57	13·23	20
14	Do. and Cumbu	21-II ..	2·97	23rd July 1881	80	27	31st August 1881	4,032	1,358	39	7·44	10
15	Do. do.	27-II ..	2·05	22nd July 1881	60	29	9th September 1881	3,418	1,667	49	10·25	14
16	Do. and Planter's Friend ..	29-A ..	1·04	22nd March 1881	50	48	17th July 1881	7,248	6,969	117	1·43	10
17	Do. do. ..	30-A.-II ..	·25	11th May 1881	8	32	19th September 1881	483	1,932	131	16·26	29
18	Raghi	30-B ..	1·99	1st December 1881	32	16	20th January 1882	3,040	1,528	51	7·00	10
19	Amber Sugar-cane	E. G. ..	·18	12th August 1881	5¼	29·1	31st October 1881 to 11th November 1881.	2,887	16,039	80	16·79	30
20	Planter's Friend	4 A.D. ..	·60	6th August 1881	13	22	24th December 1881	8,940	14,900	140	35·56	44
21	Amber Sugar-cane	10-B. East.	1·47	9th December 1881	25	17·0	28th March 1882	2,856	1,943	109	7·00	10
22	Sugar-cane	30-A.-2 ..	·25	21st September 1880	Planted.		6th December 1881	1,325	5,300	441	75·10	106

This statement, is given in accordance with the usual practice, but it affords little or no instruction, from the very varying conditions under which the different crops were produced. Many of the crops were not sown for fodder, but were cut for fodder, simply because they did not promise to be worth keeping for producing grain. And usually, at the farm, fodder crops are grown merely as "catch" crops, when opportunity occurs, usually at a season of the year, at which it would be useless to sow a crop for producing corn. Again, the worst of the land is usually employed in fodder-raising.

11. One very good crop of yellow cholum (*Sorghum vulgare*) was grown on a piece of land in fair condition, the yield was nearly 20,000 lb. per acre. This was without irrigation. The plot under sugar-cane was a piece of very inferior land, which received but poor treatment; the plants were very severely attacked by white-ants. Putting the whole outturn together, it will be observed that 34·01 acres of land yielded 112,460 lb. of fodder, or 3,307 lb. per acre.

12. In addition to the produce that was harvested, many of the fields afforded grazing for some time.

UNIRRIGATED CEREALS.

13. Unirrigated cereals were raised on 36·85 acres. No hot-weather crops were sown, on account of the absence of rain at the usual sowing season. The next statement, affords information regarding the crops raised:—

Unirrigated Corn Crops.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.	
				Date of	Seed sown.		Date.	Outturn.					Inches.	Wet Days.
					Total.	Per Acre.		Grain.	Straw.	Grain per Acre.	Straw per Acre.			
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.		
1	Amber Sugar-cane	4-A. C. ..	·60	6th August 1881.	10·5	17·5	Between 19th October 1881 and 25th November 1881.	276	11,427	460	19,045	74	16·04	24
2	Reana Luxurians	4-A.E. ..	·60	6th ,, ,,	8	13·3	26th December 1881.	277	7,355	462	12,258	142	35·56	44
3	Amber Sugar-cane	10-A. west.	1·78	11th November ,,	37·5	21·	22nd February 1882.	251	15,911	141	8,939	103	19·65	17
4	Do. do.	B.G. Plot B.	·18	12th August ,,	5·25	29	Between 31st October 1881 and 11th November 1881.	53	2,856	294	15,867	80	12·58	21
5	Planter's Friend..	13 ..	1·35	15th October ,,	63	46·6	20th February. 1882.	1,573	16,233	1,165	12,024	141	23·91	27
6	Maize, Hawkesbury River ..	15-A ..	2·08	15th September ,,	50·5	24	4th January ,,	2,168	16,660	1,042	8,009	147	32·12	36
7	Horse-gram	18 ..	4·59	17th December ,,	100	21·8	21st March ,,	724	7,284	158	1,587	94	5·27	7
8	Do.	19 ..	3·79	19th ,, ,,	49	12·9	..	Not harvested.						
9	Planter's Friend	21-B ..	2·97	28th September ,,	80	26·9	15th February ,,	790	26,350	266	8,872	140	26·72	31
10	Raghi	23-B ..	4·2	13th October ,,	71	16·9	25th January ,,	2,099	9,437	499	2,247	104	23·91	27
11	Do.	28-II ..	·40	3rd December ,,	9	22·5	28th March ,,	170	516	425	1,290	115	7·00	10
12	Do.	28-III A.	·99	3rd ,, ,,	18	18	16th ,, ,,	480	1,009	485	1,019	103	7·00	10
13	Horse-gram	28-IV ..	1·06	21st January 1882.	33	31	..	Grazed by sheep.						
14	Planter's Friend	31 ..	1·06	8th September 1881.	24	22·6	10th January ,,	116	11,056	109	10,430	124	33·10	40
15	Raghi	32 ..	2·38	3rd ,, ,,	67	28	24th December 1881.	875	11,315	367	4,754	114	28·78	34
16	Sorghum Saccharatum	33 ..	1·77	6th ,, ,,	19	10·7	2nd January 1882.	1,143	21,351	646	12,062	136	32·90	39
17	Raghi	34-I ..	1·38	7th November ,,	20	14·5	11th February ,,	422	6,522	305	4,726	96	21·51	20
18	Planter's Friend..	B. G. ..	·18	15th September ,,	3	16·6	16th January ,,	98½	1,705	547	9,472	123	32·30	37
19	Amber Sugar-cane	Do. ..	·07	12th August ,,	¼	4	18th and 22nd October 1881 and 9th and 17th November 1881.	20	1,466	284	20,942	97	12·53	20
20	Clarence River Maize .. .. / Hawkesbury River Maize ..	Do. ..	·22	8th September ,,	3	13·6	27th December 1881.	240	1,197	1,091	5,441	110	28·78	34
21	Broom Millet	Do. ..	·25	4th October ,,	4	16	14th January 1882.	240	1,064	960	4,256	102	24·96	29
22	Black Cholum	Do. ..	·25	30th September ,,	5	20·	13th ,, ,,	139	1,120	556	4,480	105	26·71	30
23	Sorghum Saccharatum	..	2·0	7th ,, ,,	18	9	4th and 5th January 1882.	1,256	14,672	628	7,336	119	33·10	40
24	Clarence River Maize	11 ..	1·48	13th ,, ,,	30	20·02	2nd January 1882.	1,210	7,935	818	5,361	111	32·10	37
25	Horse-gram	7 ..	1·40	29th December ,,	30	21·4	11th April ,,	326	1,847	232	1,319	103	4·32	6

The outturn of the crops, with a few exceptions, is generally fair. As has already been noticed, there was a considerable area of crop in flower in November, when the heavy rains occurred, which prevented proper fertilization.

14. MAIZE.—Had it not been for the circumstances just noticed, the maize crop would have been a heavy one; as it was, the yield was good, considering the nature of the soil on which the crops were grown. Plot A of Field No. 15 gave an outturn of 5,673 cobs per acre, which yielded 1,042 lb. of maize, while Field No. 11 gave an outturn of 4,027 cobs per acre, which yielded 818 lb. of grain; and the yield of straw in both cases was good. The straw was remarkably sweet, and had it been crushed when the cobs were gathered a considerable quantity of jaggery might have been made from the juice. However, this saccharine matter was not wasted, for it greatly added to the value of the straw, when used for feeding the cattle. The plot of maize produced in the experimental grounds, also yielded well, the outturn was 1,073 lb. of grain and 5,354 lb. of straw, per acre. A portion of the straw, of this experimental plot, was crushed when the cobs were gathered, and from the juice obtained jaggery was made, the outturn was about 3 per cent. of the weight of the straw. The details of the experiment are noted under "Manures."

15. The maize seed, was imported from Sydney, in September last. It was sown in alternate lines with cotton; in No. 11 field on ridges, and in No. 15 field, on the flat surface. The grain was all tarred to prevent it from being carried away by crows, squirrels, or rats, or from being eaten by the coolies when engaged in sowing it. The process followed in preparing the seed, is as follows:—

"Take one and-a-half pints (about half a Madras measure) of hot water and add about one-twelfth of a pint (about one-fourth of an ollock) of tar; stir well together. After allowing the solution to cool, pour it over about twenty measures of maize; mix together until the seed assumes a dark mahogany color, and then dust it with sand, saw-dust, or dry earth, to prevent the seeds adhering together."

From a sowing of 80·5 lb. of seed, an outturn of 3,378 lb. of grain, and 24,595 lb. of straw was obtained. About 2,500 lb. of the acclimatized maize seed, have been placed at the disposal of the Collectors for district experimental cultivation. The maize crop, is one worthy of much attention in this country. Without the aid of irrigation water, on the poor soils of the farm, good tillage and the moderate use of manure, secured the production of an average outturn of 984 lb. of grain and 6,270 lb. of straw per acre; valuing the grain at 30 lb. per one rupee and the straw at Rs. 8 per ton, prices readily obtainable, the crop was worth Rs. 55-3-1 per acre, while the expenses incurred on tillage, manure and harvesting amounted to not more than Rs. 30 per acre. Unfortunately, the greater portion of the farm is too sandy for the production of maize; the soil does not afford the plants anchorage, they fall down when the ground becomes saturated, if there is any wind. It is surprising that maize has not yet received any attention in this country for the production of malt, for use in brewing; barley is so difficult to obtain, and is always so very inferior.

16. BROOM MILLET (a variety of *Sorghum*).—This crop was grown on the farm for the first time. The seed was obtained from Sydney. The outturn, 960 lb. of grain and 4,256 lb. of straw, per acre, was very good. The crop grew luxuriantly to an average height of about 11 feet, though on a very poor sandy soil. The grain is very similar to ordinary cholum, but it has more husk. The straw was quite destitute of saccharine matter. The panicle which carries the seed has numerous stalks, all from a common centre, which, being long and wiry, are, after the removal of the seed, well adapted for use in the manufacture of brooms; and it is for this purpose that much of the broom corn crop is reared, in the United States. The crop under report, is the first, it is believed, that has been grown in this country. A large quantity of the acclimatized seed, will be distributed for district experiments.

17. BLACK CHOLUM.—This is the black variety of cholum (*Sorghum vulgare*) which is grown in some of the Southern Districts. In its general appearance the

plant is very similar to the *Sorghum saccharatum*, but while the latter contains a large quantity of saccharine juice, the black cholum contains none. Mr. Wilkins, the Botanical Lecturer in the Agricultural College, has furnished the following statement, in which he compares the Botanical characters of the black cholum, with those of the *Sorghum saccharatum*, it having been thought that the plants were identical :—

	Indigenous.	Introduced.
	Sorghum vulgare (black cholum).	*Sorghum saccharatum* (*Chinese Sugar-cane*).
Panicle.	Branches not strictly verticellate (sub-verticelled).	Branches drooping, verticelled.
Calyx of hermaphrodite flowers.	Valve black and shining, back smooth. White cilia round the margins.	Less black, not shining. Both valves hairy.
Corolla of hermaphrodite flowers.	One of the valves of the corolla awned.	One valve awned. The specimen sent therefore is the *Holcus saccharatus* of Linnaeus, and not the *Holcus saccharatus* described by Roxburgh, the corolla of which has no awn.
Calyx of neuter flower.	2 valved.	1 valved.
Stem.	Single, smooth, round. Less thick than stem of *Holcus saccharatum*.	Jointed, sometimes ramous thicker than stem of the black cholum.

The grain being an inferior one, and the straw devoid of saccharine juices, the crop seems scarcely worth attention ; for, where it can be grown, the *Sorghum saccharatum* would thrive.

18. MINNESOTA EARLY AMBER SUGAR-CANE.—This is a variety of sorghum which originated, in the State of Indiana in 1860, from a plant which appeared in a crop of Chinese sorghum. The seed of this plant was sown, and the produce again sown, which, having been repeated for several years, a large quantity of the seed has been produced. Through the agency of the United States Agricultural Department, the seed has been widely distributed over the various States, more specially in Minnesota where it has thriven well.

19. This Department is indebted to the courtesy of Messrs. Allen and Co., of New York, for the seed first experimented with, at Saidápet. The supply consisted of half-a-bushel of well-grown seed. Since the arrival of the seed in May 1879, several crops of Amber sugar-cane have been produced on the farm. It will be noticed that 2·63 acres of this crop, raised from 53½ lb. of seed, yielded an outturn of 600 lb. of grain and 31,660 lbs. of straw, equal to 228 lb. of grain and 12,038 lb. of straw per acre. The outturn must be considered as considerably below the average, as the crops were experimentally cut, in different stages of growth, most portions, before the seed appeared, while, the large plot, 1¾ acres, was sown very late in the season, and had to encounter a long drought.

20. Numerous experiments were made in crushing the canes of this sorghum, and converting the juice into jaggery. The following are the results of one set of experiments :—

Number of Experiments.	Date of Experiment.	Number of Canes crushed.	Weight of Canes.	Weight of Heads.	Yield of Juice.			Yield of Jaggery.		
					Volume.	Weight.	Percentage weight of the Cane.	Weight.	Percentage of the Juice.	Percentage of the Canes.
			LB.	LB.	MRS. OLLS	LB.		LB. OZ.		
1 ..	19th Oct. 1881..	1,000	593	79	48 4	197	33·22	23 12	12·00	4·00
2 ..	20th ,, ,, ..		525	47	44 0	164·25	31·28	27 0	16·43	5·14
3 ..	21st ,, ,, ..		476	45	38 0	149	31·30	22 8	15·10	4·72
4 ..	22nd ,, ,, ..		474	46	39 4	154	32·48	21 8	13·96	4·53
5 ..	24th ,, ,, ..		457	38	32 4	141	30·85	17 4	12·23	3·77
6 ..	25th ,, ,, ..		452	41	30 0	137	30·30	20 0	14·59	4·42
7 ..	31st ,, ,, ..	1,300	500	40	35 0	139	27·80	21 8	15·46	4·30

21. A number of other experiments were instituted in February, the results of which, are recorded in the next table :—

Date of Experiment.	Weight of the Canes with Leaves, used for the experiment.	Weight of Ripe Canes stripped, used for crushing.	Weight of Unripe Canes not crushed.	Weight of Leaves stripped.	Weight of Heads of Ripe Canes.	Total weight of Canes with Leaves and Canes.	Quantity of Juice.		100 lb. of Canes yielded Juice.	Quantity of Jaggery made.	100 lb. of Juice yielded Jaggery.	100 lb. of canes yielded Jaggery.
							Volume.	Weight.				
	LB.	LB.	LB.	LB.	LB.	LB.	MADRAS MEAS.	LB.	LB.	LB.	LB.	LB.
3rd Feb. ..	1,464	..	..	..	..	1,464	52·5	194	13	25	12·8	1·7
4th ,, ..	1,335	..	..	..	..	1,335	63	231	17	27	11·6	2·0
6th ,, ..	..	382	756	66	56	1,260	48	182	48	24	13·1	6·3
7th ,, ..	..	1,027	1,064	112	140	2,343	124·5	498	48	60	12·0	5·8
9th ,, ..	..	365	686	..	117	1,168	44·5	177	48	30	16·9	8·2
10th ,, ..	..	479	280	51	67	877	67·5	270	56	30	11·1	6·2
11th ,, ..	..	428	368	46	63·5	905·5	57	228	53	30	13·1	7·0
14th ,, ..	..	383	207	60	42	692	43	172	45	18·5	10·7	4·8
17th ,, ..	..	422	504	53	56	1,035	53	212	50	24	11·3	5·6
22nd ,, ..	..	494	509	56	54	1,113	53	212	43	28·75	13·5	5·8
23rd ,, ..	..	792	756	80	74	1,702	98·5	394	50	38	9·6	4·8

These experiments, it will be observed, were conducted in a somewhat different manner. It was found when they were begun, that not more than 50 per cent. of the plants were sufficiently ripe, but, as the experiments were intended to be continued over two or three weeks, it was not thought advisable to wait for the canes all to become ripe, for those unfitted for crushing could be usefully employed for feeding the milch cattle. From the table, it will be seen that, on the first two days, the outturn of jaggery was very poor, but on these days the *whole* of the plants were crushed. The yield of jaggery being so low, while its color was so dark, it was thought advisable to crush only the more ripe canes. It will be observed that when this was done the percentage of juice became considerably greater, as well as, the percentage of jaggery. It is evident from these experiments, that it is in every way better to crush only the best canes, and to use those that are less ripe, and the leaves, for feeding stock. By selecting the seed, and by good tillage and good treatment, it will, I think, be possible to secure much greater uniformity in the ripening of the canes. This, is a point to which attention is specially required, for it is both troublesome and expensive to divide the crop into matured and unripe canes; and, but little advantage would be gained by harvesting, first, the matured canes, and afterwards, the others as they ripened.

22. Cream of lime was mixed with the juice before it was boiled until an alkaline reaction was observed. Crystallization began, usually, within twenty-four hours after the syrup cooled; in some cases much earlier. Experiments were made to ascertain the proper time when the syrup should be removed from the fire, and under what conditions the best colored jaggery could be obtained. It was noticed that the syrup was lighter in color when removed from the fire early, but crystallization was slower. When the juice was boiled for a longer time, it became darker, but crystallized rapidly.

23. The syrup of the Amber sugar-cane crystallizes far more rapidly, and to a much more considerable extent, than the syrups of either Sorghum saccharatum or Sorghum Kaffrarium. The refuse canes, after crushing, are far more palatable to stock than refuse of sugar-cane; and, judging from its appearance and general character, the refuse sorghum must be far more digestable.

24. A small packet of the seed of this variety of sorghum was received in July last from the Government of India. The packet contained only about 4 oz. of seed; but it was in a very fresh state, 80 per cent. of it being vital. A small plot measuring 336 square yards was sown with this seed; the cultivation results appear at No. 19 in the statement. Some experiments were made in manuring this crop, particulars of which will be found under head "Manures."

25. This crop appears to have become thoroughly established at Saidápet, and its distribution over the Presidency can thus readily be secured. Under fairly good conditions of soil and climate, such as are generally secured for the ordinary sugar-cane crop, this new variety of sorghum cannot fail in being a very heavy producer. The experiments made at Saidápet seem to show that the best time for cutting the plant for crushing, is when the seed begins to harden; thus, the seed is secured as well as the canes, and, while the juice of the canes may be converted into jaggery or sugar, the cane-refuse is well adapted as fodder for stock; thus, the crop becomes, a grain, sugar, and fodder producer.

26. CHINESE SUGAR-CANE (*Sorghum Saccharatum*).—This crop, it will be observed, grew very satisfactorily. The seed was obtained from Sydney. From 37 lb. of seed sown the produce was 2,399 lb. of grain and 36,023 lb. of straw, equal to 636 lb. of grain and 9,555 lb. of straw per acre, and the period of growth was, on the average, only 128 days. The difficulties experienced last season, in getting the syrup of this *sorghum* to crystallize were so great that no attempts were made to prepare jaggery. The canes were used in feeding the stock, both dairy and working cattle.

27. PLANTER'S FRIEND (*Sorghum Kaffrarium*).—Further experience confirms the opinion expressed in previous reports, regarding the hardiness of this variety of sorghum. From 170 lb. of seed sown the produce was 2,577 lb. of grain and 55,344 lb. of straw, and the average period of growth was 132 days. Several experiments were made in converting the juice of the canes into jaggery. The following are the results:—

Date of Experiment.	Where grown.	Weight of Ripe Canes stripped.	Weight of Heads of Ripe Canes.	Quantity of Juice.		100 lb. of Canes yielded Juice.	Quantity of Jaggery made.	100 lb. of Juice yielded Jaggery.	100 lb. of Canes yielded Jaggery.
				Volume.	Weight.				
		LB.	LB.	MADRAS MEAS.	LB.	LB.	LB.	LB.	LB.
1. Feb. 15th.. ..	Field. 13	817	116	90	360	44	37	10·3	4·5
2. ,, 16th.. ..	Do.	787	162	69	276	35	35	12·6	4·4
3. Oct. 26th.. ..	Do. 4	280	45	23	112	40	10·75	9·6	3·8
4. ,, 27th.. ..	Do.	500	35	36	124	24·8	17	13·7	3·4
5. ,, 28th and 29th.	Do.	593	37	39	161	27	22	13·6	3·7

28. REANA LUXURIANS.—This was grown as an ordinary field crop. The outturn of both fodder and grain was good, but the weather during the experiment was unusually favorable. On good soils, under liberal treatment, when it can obtain plenty of rain or irrigation water, the crop grows most rapidly and luxuriantly; but it cannot withstand a drought. Indeed, the experiments made showed that a drought, which scarcely affected the sorghum crops, was sufficient to check the growth of the Reana to such an extent, as to render it useless to keep the crops standing longer. As a fodder crop, in a damp warm climate, or where irrigation can be secured, it is well worthy of attention. There is perhaps no other crop, sugar-cane excepted, which will produce such an enormous quantity of green plant per acre, but the fodder is very watery, and does not appear to be very palatable to stock when offered for the first time. The watery juices of the stem, appear to be destitute of saccharine matter, during all stages of growth. The grain, is almost useless as food. The following experiments were made, in order to determine the best means of preparing the grain as food for stock. The results, it will be observed, were discouraging:—

"(1.) A quantity of the grain was placed in cold water, and allowed to soak for 56 hours. At the end of this time the grain was almost as hard as when first placed in water, while it bad increased only about 10 per cent. in volume.

(2.) Half-a-measure of the grain was boiled for 6½ hours. At the end of this time the shell was perfectly hard, though the inner portion was soft; still it was quite impossible that the grain could be masticated by any animal. After boiling, the grain measured 6½ ollocks, which was an increase of 62 per cent. It appeared to be useless to continue the boiling process longer. The boiled grain, when cold, was offered to several sheep, all of which refused to eat it.

(3.) Half-a-measure of the grain was placed in a stone mortar and was beaten for two hours with a heavy pestle, but none of the grain was crushed.

"(4.) Half a measure of the grain was placed in a powerful corn-crushing mill. The grain in passing through the mill was partly crushed, but only very imperfectly, and it was necessary to pass it seven times through the mill to get the grain powdered; and this was only a rough coarse powder. This powdered grain was offered to a number of sheep, but again it was refused."

29. RAGGY (*Eleusine corocana*).—The total area under this crop was 9·35 acres, which produced 4,046 lb. of grain and 28,799 lb. of straw, equal to 433 lb. of grain and 3,080 lb. of straw per acre.

30. HORSE-GRAM (*Dolichos uniflorus*).—Horse-gram is grown on the farm generally as a "catch" crop after the harvesting of the ordinary crop, chiefly for grazing down, or for ploughing into the ground as "green manure." The yield of the crops that are allowed to mature, is usually very small.

31. IRRIGATED CEREAL CROPS.—These crops were raised on 14·28 acres; of this area 11·17 acres were irrigated from the Mylapore Tank, and this, on account of the deficient monsoon rains, never filled, and became quite dry when most of the paddy was only half matured, thus, necessitating the raising of water from wells. The total produce of the single crop on 14·28 acres, amounted to 13,963 lb. of grain and 58,649 lb. of straw, or 978 lb. of grain and 4,107 lb. of straw per acre. The Madagascar paddy was not successful, which must be attributed mainly to the almost entire failure of the rains in October, and the unusually high temperature. The chief crop of this variety of paddy was sown in September, long before any other paddy, and during October there were 27 days on which rain fell, and no irrigation water was then available; it is, indeed, surprising that after the long drought the crop should have survived and matured. The heavy rainfall of November saved the crop, but it never recovered the vigor which characterized its earlier growth, and coming prematurely into flower when the heavy rains occurred, proper fertilization was prevented. From an unfortunate misunderstanding, nearly the whole of the seed that was in store, 1,763 lb. of the previous year's production, was distributed for district experiments, before it was ascertained that but very little remained for the use of the farm, and this, only refuse seed much mixed with indigenous grain. Next season, experiments will be made with seed raised in the districts, from farm seed, when, it is hoped, comparative data will be collected showing the quantity of water needed, per acre, for rearing the indigenous, and the Madagascar paddy, under similar conditions.

32. The following extracts from correspondence, show the commercial value of the Madagascar rice:—

"In my letter, No. 820, dated the 21st of September 1877, printed with Board's Proceedings, No. 4633, dated the 4th October 1877, I referred to a variety of Madagascar paddy, of which I had received a small sample from the Rev. Mr. Toy, a Missionary residing in Madagascar. In that letter, I pointed out my reasons for believing that Madagascar was the home of the Carolina rice of America. It is possible that the special variety of paddy we have obtained may not be the parent of the American variety. It, however, possesses many similar characteristics, amongst which I may mention preference for a *moderate* supply of irrigation water, strong robust straw, heavy yield, large grain, and, difficult to thrash. The rice is certainly inferior to Carolina rice, but this, may be due, partly to soil, and to the superior processes through which Carolina rice passes, in its preparation.

* * * * *

"I forward a sample of the paddy in the straw—a sample of the grain (*a*) and two samples of the rice—the one (*b*) prepared in the raw state and the other (*c*) after moderate boiling. It would be an advantage if a professional valuation of the grain and rice could be obtained in London.

* * * * *

Board's Resolution thereon—

* * * * *

"The product of the experimental cultivation of this variety of rice appears to the Board to be of superior quality, and if Mr. Robertson's present opinion, that it thrives with a quantity of water less than the indigenous varieties, should be confirmed by further experience, the result should be of great value to localities, where the rainfall is scanty and water not always abundant.

"Government may be disposed to obtain a professional valuation of the rice as suggested in paragraph 5."

The samples were accordingly sent to the Most Honorable the Secretary of State for India in view to their professional valuation. The following are the reports on the samples :—

"Report on three samples of Madagascar rice from Madras, received for valuation from the India Office, dated London, 27th August 1881.

"A. Madagascar paddy : bright and clean, but wanting in plumpness. Value about 6*s.* per cwt. (the freight would be a heavy item in importing rice in this form, as paddy is usually charged at 15 cwt. to the ton for freight).

"B. Very imperfectly cleaned rice : value for starch-making 8*s.* 6*d.* per cwt.; it would have to be recleaned for eating purposes.

"C. Fairly cleaned rice from paddy unhusked in boiling water : value 8*s.* 6*d.* per cwt. (there is an unusual demand for this sort of rice just now).

"(Signed) THOS. GRAY AND WALKER."

"*Note.*—All the samples much weevilled."

"Report on three samples of Madagascar paddy and rice from Madras, received from the India Office, dated 30th August 1881.

"A. Madagascar paddy.—This is difficult to value as the amount of husk is unknown, but we should think it would be about 25 per cent.; in that case the value would be about 6*s.* to 6*s.* 6*d.* until a portion had been cleaned ; it would be impossible to give a nearer quotation.

"B. Madagascar rice, raw.—Badly weevilled ; value 7*s.* to 7*s.* 3*d.* per cwt.

"C. Madagascar rice, boiled.—Considerably weevilled ; value 7*s.* 9*d.* to 8*s.* per cwt.

"The samples B and C being *weevilled* would, in the process of cleaning, break very considerably, and for that reason we are afraid to quote a higher valuation. The present prices of all rice on the spot are low, and distant shipments of soft grain rice (Rangoon, Bassein, &c.,) are about 9*d.* per cwt. dearer than spot values chiefly owing to the unfavorable harvest prospects. We think, therefore, that during the next two or three months we may reasonably expect better prices.

"(Signed) DEVITT AND HETT."

On receipt of these valuations, the Chairman of the Chamber of Commerce, Madras, was asked for information, showing the prices of ordinary Madras paddy and rice in the London Market at the time the foregoing valuations were made. He was good enough to reply as follows :—

"At the end of August, when the samples of Madagascar rice from Madras were reported upon by Messrs. Thos. Gray and Walker and Devitt and Hett in London, a good deal of Madras rice was sold in London as low as 7*s.* per cwt."

It will be observed, on referring to the General Report of this Department, that in some of the districts the Madagascar paddy experiments proved fairly successful. But the majority of the experiments, suffered from adverse conditions, the lot, too frequently, of experimental crops.

33. The next statement shows the outturn of the Cereal Irrigated crops produced during the year :—

Irrigated Cereal Crops.

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.						Duration of Growth.	Rainfall.	
				Date of	Seed sown.		Date.	Outturn.						Inches.	Wet Days.
					Total.	Per Acre.		Grain.	Straw.	Grain per Acre.	Straw per Acre.				
			ACRES.		LB.	LB.		LB.	LB.	LB.	LB.	DAYS.			
1	Goondu Sumba Paddy ..	29-B	·74	19th November 1881 ..	Planted.		24th March 1882 ..	805	2,443	1,486·5	4,773	126	10·70	13
2	Car Paddy							295	1,089					
3	Madagascar Paddy	30-A. I ..	1·77	10th September ,, ..	52	29·4	26th January ,, ..	550	3,920	310	2,214	138	32·60	39
4	Goondu Sumba Paddy ..	35-B	·61	8th October ,, ..	80	131	13th March ,, ..	1,237	4,084	2,028	6,695	156	23·91	27
5	Madagascar Paddy ..	35-C	·41	18th November ,, ..	Planted.		28th ,, ,, ..	38	74	300	3,388	130	10·70	13
	Sumba Paddy						25th ,, ,, ..	85	1,315					
6	Goondu Sumba Paddy ..	36-III ..	·90	16th ,, ,, ..	Do.		8th ,, ,, ..	1,770	5,210	1,967	5,789	112	10·70	13
7	Do. ..	36-II ..	·46	15th ,, ,, ..	Do.		8th ,, ,, ..	721	1,003	1,567	2,180	113	10·90	14
8	Car Paddy	36-I	1·58	26th ,, ,, ..	80	50	28th ,, ,, ..	852	1,108	539·2	701	122	7·05	11
9	Goondu Sumba Paddy ..	37-A	·45	23rd ,, ,, ..	60	133	24th ,, ,, ..	586	2,262	1,302	5,027	121	7·05	11
10	Sumba Paddy	37-B	·82	22nd ,, ,, ..	70	85	23rd ,, ,, ..	684	3,116	834	3,800	120	7·30	12
11	Do.	37-C	·46	22nd ,, ,, ..	65	141	22nd ,, ,, ..	340	1,508	739	3,278	120	7·30	12
12	Do.	37-D	·52	22nd ,, ,, ..	65	124	21st ,, ,, ..	596	1,782	1,146	3,427	119	7·30	12
13	Car Paddy	37-E	·67	22nd ,, ,, ..	Planted.		6th ,, ,, ..	409	2,939	616	4,386	104	7·30	12
14	Do.	R. F. I. ..	·27	9th April ,, ..	Do.		14th July 1881 ..	410	2,270	1,518	8,407	96	1·43	10
15	Sixty days' Sumba Paddy ..	R. F. I. ..	·27	28th July ,, ..	70	258	10th November ,, ..	259	793	959	2,937	105	22·45	35
16	White Car Paddy	R. F. II ..	·61	25th April ,, ..	65	106·5	3rd September ,, ..	265	4,821	434	7,903	131	11·18	23
17	Car Paddy	R. F. III ..	·52	6th ,, ,, ..	Planted.		12th July ,, ..	958	4,082	1,842	7,850	97	1·29	8
18	Sixty days' Sumba Paddy ..	R. F. III ..	·52	30th July ,, ..	30	57·6	18th October ,, ..	186	536	261	1,030	80	18·19	25
19	Madagascar Paddy	R. F. IV. ..	·39	18th June ,, ..	25	64	28th ,, ,, ..	217	539	556	1,382	132	19·77	32
20	Car Paddy	R. F. V. ..	·53	6th April ,, ..	Planted.		12th July ,, ..	460	5,562	867	10,494	97	1·29	8
21	Sumba Paddy	29-A. N. ..	·94	23rd November ,, ..	63	67	21st March 1882 ..	1,299	5,208	1,382	5,540	118	7·05	11
22	Do.	29-A. S. ..	·84	23rd ,, ,, ..	57	67·8	21st ,, ,, ..	991	2,985	1,179	3,553	118	7·05	11

34. A small packet of paddy, said to be Carolina paddy, was received from the Government of India for experimental trial. The experiment was made; but as was anticipated the grain proved not to be Carolina paddy, but a very inferior variety of indigenous paddy.

INDUSTRIAL CROPS.

35. 38·69 acres were under these crops; of which 12·60 acres were standing at the beginning of the year. Of the crops sown in the year, 27·09 acres were standing at the close of the year, the produce of which cannot be reported until next year. These are cotton 19·36 acres, oil-seeds 6·71 acres, and indigo 1·02 acres.

36. CASUARINA TREES (*Casuarina Muricata*)—The plantations continue to thrive. An account has been opened for each plantation, and it is hoped that data will be collected, which, will be of use in showing the cost per ton, of the fuel produced under different systems of planting. At an auction sale held in Febreary, 100 trees were sold for Rs. 194-4-0, or nearly 2 rupees per tree; the buyers cut down the trees and removed them, at their own expense. None of these trees were over ten years of age. Some were under eight years. Another lot of ten trees were sold by weight; they weighed 3,796 lb., and the price obtained for them at Rs. 9 per ton, with one rupee obtained for the roots was Rs. 16-4-0, or Rs. 1-10-0 per tree. Of course, the trees cut down were the best in the plantations. The object in planting the land with Casuarina trees, was chiefly to improve the soil, and to utilize land, which for arable tillage was almost worthless. The intention is, to plant the land with fruit-bearing trees, such as guavas, mangoes, &c., as the Casuarinas are removed. During the year 8·93 acres of poor sandy outlying land were planted with Casuarinas.

37. The following statement, shows the industrial crops harvested during the year;—

Industrial Crops.

Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					
			Date of	Seed Sown.		Date.	Outturn.				
				Total.	Per Acre.		Gross.		Per Acre.		
		ACRES.		LB.	LB.		Seed, LB.	Leaves.	Seed. LB.	Leaves.	
Castor-oil seed	1 *a*, *b*.	2·38	2nd October 1880 ..	33	13·8	14th June 1881 ..	91	..	38	..	
Indigo	15 *a*.	4·17	10th December 1880 ..	45·5	10·9	31st August 1881 ..	221	Bundles. 147	53	Bundles. 35	
Do.	15 *b*.	2·00	9th December 1880 ..	30	15	5th September 1881 ..	623	..	311	..	
Do.	Do.	1·91	9th December 1880 ..	28	14·6	5th September 1881 ..	Cotton-in-seed.	219	Cotton-in-seed.	115	
Cotton	10 *a*.	1·78	1st October 1880 ..	16	9	27th September 1881 ..	486	..	273	..	
Do.	10 *b*.	2·47	2nd October 1880 ..	20	8·1	3rd October 1881 ..	578·25	..	234·1	..	
Do.	18	4·69	16th September 1880 ..	74	16·1	29th October 1881 ..	852·75	..	185·8	..	
Do.	34 *a*.	1·38	15th September 1880 ..	22	15·9	15th October 1881 ..	186·50	..	135·1	..	

It must be remembered that these crops were sown in 1880-81, and were merely harvested, in the year under review. The outturn generally is very low, attributable to the absence of seasonable summer rains, and the low drought-resisting power of the soils of the farm.

38. The next statement, shows the percentage outturn of lint, obtained from the cotton crops of last season :—

Month.	10-B. East.			10-B. West.			10-A. North.			10-A. South.			18. North.			18. South.			18. Headlands.			34.		
	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.	Cotton in Seed.	Lint.	Percentage of Lint.
	LB.	LB.		LB.	LB.		LB.	LB.		LB.	LB.		LB.	LB.		LB.	LB.		LB.	LB.		LB.	LB.	
March 1881.	24·75	6·75	27·3	23	6·25	27·2	16	5	31·3	13·50	4·25	31·5	32·75	8·75	26·7	33·75	8·50	25·2	17	5·50	32·4	4·50	1·25	27·8
April ,,	7·25	2	27·6	6·25	1·75	28	6·50	1·75	26·9	8·25	2·50	30·3	23·50	6·25	26·6	15	4	26·6	9·50	3	31·6	11	2·75	25·0
May ,, ..	31	10	32·3	23·25	6·75	29·0	49·75	16	32·2	29·50	7·25	24·6	14·75	3·50	23·7	17	4·50	26·5	6·25	1·75	28·0	4·50	1·50	33·3
June ,, ..	93·75	28·50	30·4	108	31	28·7	97·50	24	24·6	74·25	18·75	25·3	32·25	8	24·8	28·75	9	31·3	14·25	3·75	26·3	2·75	·50	18·2
July ,, ..	71·50	22·25	31·1	47·75	15·75	32·9	38	12	31·6	31·75	10·25	32·3	11	3·25	29·5	13	4·25	32·7	..	..	..	37·75	11·75	31·1
Aug. ,, ..	44	13	29·5	58·75	17·50	29·8	54	16	29·6	24·25	7·75	31·9	8·50	2·50	29·4	5·25	1·75	33·3	8	2·25	28·1	34·75	10·25	29·5
Sept. ,, ..	16	4·50	28·1	16·75	4·75	28·4	18·75	5·50	29·3	24	8·25	34·4	..	..	..	8	2·25	28·1	..	..	..	28	8·25	29·5
Oct. ,, ..	..	..	..	6·25	1·75	28·0	..	..	..	..	..	..	284·25	87	30·6	231	71	30·7	39	9	23·1	63·25	19	30·0
Total ..	288·25	87	..	290	85·50	..	280·50	80·25	..	205·50	59	..	407	119·25	..	351·75	105·25	..	94	25	..	186·50	55·25	..
Per Acre ..	233·4	70·4	30·2	234·8	69·2	29·5	315·2	90·2	28·6	230·9	66·3	28·7	251·2	73·6	29·3	185·2	55·4	29·9	87·8	23·4	26·7	135·2	40·0	29·5

It will be observed that the percentage of lint varied from as low as 18 per cent to, as high as 34. It should be remembered, with reference to these results, that they have been obtained under ordinary agricultural conditions, and that, it is quite possible that in some cases the cotton-in-seed may have been damp when weighed, and might have become dry when ginned, which would, of course, make the outturn of lint apparently low. In the table below, the cost of growing, and the value of the produce obtained from the double crop—cotton and maize—harvested in the year, but sown in the preceding year, appear ;—

Description of Crop.	Number of Field and Plot.	Area.	Cost of preparation of Land.	Cost of Seed and Sowing.	Cost of after cultivation.	Cost of Harvesting and securing produce.	Value of Manure applied.	Total expenditure on Crop.	Value of unexhausted Manure carried forward.	Net cost of Crop.	Value of Produce.
			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
New Orleans Cotton and Maize* ..	10-A.	1·78	13 10 0	5 8 6	18 15 7	3 5 6	39 0 0	80 7 7	11 0 0	69 7 7	46 15 8
New Orleans Maize* and Yellow* Cholum	10-B.	2·47	10 2 0	4 11 0	20 14 6	2 4 0	42 0 0	79 15 6	12 0 0	67 15 6	55 14 2
New Orleans and Planter's Friend.	18	4·82	10 10 0	7 12 0	17 7 7	18 0 2	51 14 8	105 12 5	11 7 8	94 4 9	211 1 8
New Orleans and Yellow Cholum..	34-A.	1·87	2 4 0	3 10 0	12 3 0	5 9 0	25 8 0	49 2 0	5 1 7	44 0 5	49 12 6
Total ..	..	..	..	..	..	..	..	..	..	275 12 3	363 12 0

* Failed.

39. The following, are the results of the experiment, referred to at paragraph 41 of last year's report:—

Plot A.	Plot B.
Rows of cotton, 4 feet apart ..	Rows of cotton, alternately 2 and 6 feet apart.
Outturn of cotton, lb. 377·7 ..	Outturn of cotton, lb. 387·5 ..

The plots were of the same area, and were similarly manured and tilled. It will be observed that the outturn of the two plots differs but slightly. The wide interval between each pair of rows, gives facilities for cleaning the ground during the growth of the crop, which, the narrower uniform intervals, did not afford. The space between the pair of rows, is more difficult to weed, but this, is of minor importance compared with the advantages gained in being able to till, throughout the season, nearly two-thirds of the land.

40. INDIGO (*Indigofera tinctoria*).—The season was also an adverse one for this crop, and the outturn of plant was low. Two acres in Field No. 15 produced a fair crop of seed, the yield being 623 lb. which was sold for about 40 rupees. On the farm it generally pays best, to grow indigo only on the best soils for seed, in the cold season. In seasons when the rainfall has been more evenly distributed, than is usually experienced, indigo has yielded very considerable crops of green plant.

41. CASTOR-OIL CROP (*Ricinus communis*).—This was sown more as a "catch crop" than, as an ordinary crop of the farm. Like the indigo, and cotton crop, it suffered from drought. Several small packets of castor-oil seed of different varieties were obtained from Italy, through the courtesy of Professor Gaglioli, of the Royal Agricultural College, Naples. The following notes refer to the plants raised from these seeds :—

"The seeds were sown in pots on the 5th March 1881; they germinated very well; the seedlings were transplanted on the 11th April 1881 in beds prepared to receive them.

"(1.) *Ricinus communis* var. *Armatus*.—At the close of the year only three plants of this variety were living. This is an annual; grows to a height of six feet; it has too many side branches. The spikes are short and the capsules are of medium size; only four ounces of the seed were collected.

"*Sollingeri*.—Two plants only are living; they grew to a height of five feet. This variety seems to be an annual. The spikes are short but the capsules are large. The plants have not borne well; only two oz. of seed were collected.

"*Arcuatus*.—The plants were healthy and robust in the cold season, but died when the hot weather set in; the growth is bushy. The spikes are long and the capsules are of a medium size.

"*Rugosus chunveanus*.—Three plants of this variety are in the bed; they thrive well even during dry weather; they have grown to a height of 20 feet with a stem girth of 10 inches in 12 months. They bear well. The spikes are long and capsules closely attached to the stalk and of a good size. Some seed of this variety was collected and sown in another bed, where it has thriven even better.

"*Subrisides*.—The plants grew to a height of 10 feet with a stem girth of 8 inches. The spikes are long but the capsules are very small."

42. BRAZILLIAN COTTON.—A few plants of Brazillian cotton are at present growing in the Botanical Grounds; they are large, about 7 feet in height, and are healthy, and they grow well, as long as there is plenty of moisture in the soil, but do not thrive in dry weather; and the bolls are much attacked by insects. The lint is short, but is of good quality.

43. YCA VALLEY COTTON.—The few plants of this variety growing in the experimental grounds continue to thrive; several are of great size, with stems 5 or 6 inches in circumference. The lint maintains its very high character. A sufficiency of seed has been collected this season to plant an acre of ground. Special attention will be given to the propagation of this valuable species of cotton. It will be remembered that the cotton was referred to in very high terms in previous reports, but, the plants were attacked by a borer and nearly the whole were lost. When more seed is available, some of it will be sent into some of the districts where the plants can meet with better conditions, than at Saidápet.

44. MISCELLANEOUS CROPS.—Of these the common plantain, as usual, occupied the largest area. Several of the plots cropped with miscellaneous crops were of such a small area, full details regarding them were not registered. Some of these crops were grown on the farm for the first time. The next statement, affords information regarding the produce of the Miscellaneous crops, harvested in the year:—

Miscellaneous Crops.

Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.				
			Date of	Seed sown.		Date.	Outturn.			
				Total.	Per Acre.		Crop.		Per Acre.	
Manilla Hemp *(Musa Textilis)* ..	..	..	..	..		..	..	..	..	..
Plantain *(Musa Paradisiaca)* ..	4-B.-I ..	·93	15th March 1878 ..	Planted		During the year ..	Bunches. 654	..	Bunches. 253	..
Do. (do.).. ..	4-B.-II ..	1·25	6th June 1879							
Do. (do.).. ..	4-B.-III ..	·40	18th August 1880 ..							
Do. (do.).. ..	12-C. ..	·85	26th December 1878 ..	do.		do.	40 Tubers.	..	47 Tubers.	..
Tapioca	4-B.-III..	·40	30th November 1880 ..	do.		16th October 1881 ..	lb. 1,097½	.. Starch. lb.	lb. 2,744	.. Starch. lb.
Arrowroot	B.G. ..	·04	7th to 9th February 1881.	do.		During April	401 Fruit. lb.	28·5	10,025 Fruit. lb.	712
Brinjals	28-III-B ..	·23	11th March 1881 ..	do.		18th July 1881 ..	151	..	657	..
Tomatoes	B.G. ..	·06	2nd February 1882 ..	do.		End of April	683 Bulbs. lb.	..	11,383 Bulbs. lb.	..
Onions	Do. ..	·08	31st January 1882 ..	do.		March and April ..	126	..	1,575	..

45. MANILLA HEMP PLANT (*Musa Textilis*).—The plot of Manilla hemp plants has been considerably enlarged during the year, by planting out the shoots of the matured plants. At the present time, the plot contains the following plants:—

Full grown, about two years' old	69
Half grown	30
Young plants, a few months' old	147
Total ..	246

Besides these, there are thirty shoots fit for planting out. The plants have grown well, under the same conditions as the ordinary plantain. They will not thrive, unless planted on a deep well-manured soil, under regular irrigation. Hence, the cost of growing plants, until they reach the stage fit for cutting is great; at Saidápet, this cost will amount to not less than 2 annas each. It costs about the same sum to bring into bearing a plant of the ordinary variety of plantain, but then, the bunch of fruit may be worth 4 or 5 annas at the least, whereas, the fruit of the *Musa textilis* is of no value.

46. There seems little or no probability of the *Musa textilis* becoming an established crop, on this side of India. On the Western Coast, in some localities where irrigation and manuring are less urgently needed, the cost of producing the plants will be much less; and there, some experiments should be tried.

47. A number of plants were cut down for fibre, the following statement, gives some of the results:—

No.	Date of Experiment.	Weight of Stem.	Length of Stem.	Circumference near the Ground.	Yield of Fibre.	
					Yield of one Plant.	Percentage of the Stem.
		LB.	FEET.	FEET.	LB. OZ.	
1	12th November 1881	138	11	2½	1 2	·81
2	12th ,, ,, ...	56	6	1¾	0 6	·67
3	12th ,, ,, ...	72	9	2	0 10	·86

48. The next table shows the results of a second series of experiments:—

No.	Date of Experiment.	Weight of Stem.	Weight of Inner Portion.	Weight of Middle Portion.	Weight of Outer Portion.	Weight of the Pith.	Length of the Stem.	Circumference at the Bottom of the Stem.	Circumference at half the Height of the Stem.	Circumference at the Top of the Stem.	Yield of Fibre from			Percentage of Fibre in the Stem.
											Inner Portion.	Middle Portion.	Outer Portion	
		LB.	LB.	LB.	LB.	LB.	FT.	FT. IN.	FT. IN.		OZ.	OZ.	OZ.	
1	23rd March 1882.	58	23	..	25	10	8	2 3	1 10	1 6	4	..	1	·53
2	24th ,, ,,	78	42	..	31	5	8¼	2 6	1 11	1 6	5	..	1	·48
3	27th ,, ,,	77	22	23	27	5	8	2 6	1 11	1 6	4	1¼	1	·50

49. Some of the plants were in flower, and some bearing fruit, when they were cut. It was, of course, undesirable, as regards the production of fibre, that the plants should be allowed to stand so long as to produce fruit, but the intention had been to try to rear plants from the seeds, which was frustrated by a cyclone prostrating the plants; they were therefore utilized as already shown. The men when engaged in separating the fibre were allowed to work in their own way, in the manner adopted in extracting the fibre of the common plantain. The process is extremely clumsy, very slow, and very costly. With practice the men might have done better, but they never would be able, by their process, to produce prepared fibre at a cost sufficiently low to admit of it being sold at a profit.

50. Some rough experiments were made in crushing longitudinal sections of the stems of the common plantain through an ordinary oat-crusher. In one experiment 20 lb. of plantain stalk yielded 7½ oz. of rough fibre, but even in this case the cost was

about 2 annas per pound, much beyond the value of the fibre and the cleaning was very imperfectly done. For some purposes, it may be desirable to obtain roughly-prepared strong fibre, at a moderate cost, rather than a highly-prepared fibre, at a high cost. There is no probability of really clean fibre being turned out by the ordinary process, at a cost less than 6 annas per pound—a cost far in excess of the value of the fibre. The experiment with the corn-crusher therefore, suggests a direction in which economy may be secured in the extracting process. It was found that the iron rollers discolored the fibre. A stem-crusher formed of a pair of wooden rollers, has been constructed, but it needs further improvement. The experiments made with this machine will be noticed in the next report. Samples of this fibre, and of that prepared by the hand, in the usual way, have been sent to England for valuation.

51. It would appear, that in this part of India, it would be better to give attention to the common plantain, in view to the production of fibre, or, a paper material, rather than to spend money in endeavouring to introduce *Musa textilis*. The fibre of the common plantain is utilized only to a very small extent; the plant is grown everywhere, where water can be commanded and a suitable soil is available. The culture of the crop is well understood, and in the price got for the fruit all expenses are returned; thus, the stems are obtained almost free of cost. The following data, referring to an ordinary plantain, the stem of which was crushed for fibre, may be of interest:—

Date of experiment	17th Nov. 1880.
Weight of stem	52 lb.
Length of stem	7¾ ft.
Circumference of the stem near the ground	2 ft.
Yield of fibre	8 oz.
Percentage of the stem	1·04

It is evident, however, that the possession of a suitable mill for crushing the plant is an absolute necessity, to admit of the fibre being produced at a sufficiently moderate price to compete in the market. Several mills for extracting fibres, are now advertised by different manufacturers in the United States, and in that country inquiries will be instituted.

52. TAPIOCA (*Jatropha manihot*).—A small plot was grown in the Botanical grounds, the plants were in rows about half a yard apart; the ground was occasionally watered. The outturn of tubers was 6,487 lb. per acre. No attempt was made to extract the starch.

53. TOBACCO (*Nicotiana tabacum*).—A small supply of Virginia, Havanah, and Maryland tobacco seed, was received from Sydney. Small plots of each of these were grown in view to raising seed.

54. WHEAT (*Triticum sativa*).—A small plot sown with this crop failed to give satisfactory results. Wheat has not as yet been successfully cultivated at Saidápet, except the husked variety (*Triticum spelta*). The climate is apparently too hot, for the better kinds of wheat.

55. CHICORY (*Chichorium intybus*).—A supply of seed was obtained from Sydney; it was sown on the 26th December 1881; the crop grew luxuriantly; the plants were in flower at the close of the year. The roots are fibrous and poor.

56. TOMATOES (*Solanum Lycopersicum*).—This crop did very well indeed; it was sown on the 2nd February 1882; and during the next three months it yielded 683 fruits, varying in size from that of a gooseberry to that of a fair-sized guava. It is surprising that this crop, which grows so readily and produces so well, at a season of the year when vegetables and fruits are scarce, should be so little cultivated around Madras. In the warmer parts of America, the Tomato is very largely grown, and is used not only as a vegetable, but for making jams, pickles, &c.

57. ONIONS (*Allium Cepa*).—A small experiment was made in growing onions with seed obtained from Cuddapah. The crop matured in about two months from the time of sowing, and gave an outturn of 1,575 lb. per acre—a fair return, considering the season at which the crop was grown, the poverty of the soil, and, the short period of growth.

58. PERSIAN DATES.—Thirteen of the imported plants are living, but they have made very little progress. Some date seeds received from Egypt germinated well, and have produced a number of plants. Edible dates should thrive in South India.

59. COFFEE (*Coffea Arabica*).—The coffee shrubs continue to thrive. There are 26, all about 4 years of age; they are of an average height of 5 feet, and at the close of the year were heavily covered with blossom. The Liberian plant has made but little progress; it is $3\frac{1}{2}$ years of age, and only about $5\frac{1}{2}$ feet in height. It also was in bloom at the end of the year.

60. POTATOES (*Solanum tuberosum*).—Some Maltese potatoes were obtained, and were planted on a small plot of land; they germinated well, and several threw up strong stems; but the hot weather killed all.

61. INTRODUCED GRASSES (*Andropogon Halipense*).—The seed of this grass was obtained from the United States of America; it germinated well, and produced strong, healthy plants which have seeded. The grass is a very coarse reedy one, and is not likely to be of much value in places where Guinea grass (Panicum jumentorum) can be grown. During the hot weather of January, February and March, when this variety of grass was withered up, Guinea grass growing side by side, under similar conditions, was quite green.

62. ANDROPOGON ALBUM.—The seed of this grass was also introduced from America. The grass is apparently a good one; it produces a large number of bottom blades, even, in comparatively dry weather. It also has seeded well.

63. BUFFALO GRASS.—The roots of this grass were obtained some years ago from Australia, but the plants have made no progress, and have not seeded. The grass, does not appear to have much to recommend it.

64. PANICUM BROWNII.—The seed of this species, also, was obtained from the United States. It is an excellent grass; it has thriven at Saidápet remarkably well. When fully naturalized, it will make an excellent pasture grass. It has seeded very freely. This grass is decidedly the best that has yet been introduced into this part of India.

65. FIBRE PLANTS.—The following varieties of fibre plants were grown in the experimental grounds:—

66. HEMP (*Cannabis sativa*).—This is the common hemp plant. It grew very well indeed. Its average height was about $6\frac{1}{2}$ feet.

67. JUTE (*Corchorus olitorius*).—The growth was poor and irregular.

68. SUNN HEMP (*Crotalaria juncea*).—It grew very well indeed. The plants were both tall and free from side branches.

69. ROSELLE (*Hibiscus subdariffa*).—This crop also grew very satisfactorily; it produced tall, upright plants, and from these some good fibre was produced.

70. BENDACOY (*Hibiscus esculentus*).—This grew very well, but was short and very bushy.

71. RHEEA (*Boehmeria nivea*).—This crop grew very well during the cold season, but the plants were short, the average height being about 4 feet. The stems were straight and almost branchless, and contained a large quantity of very strong fibre. Some experiments were made in extracting the fibre by the hot-water process, but, the results were not satisfactory. The fibre was of a dark color and very gummy.

72. LINSEED (*Linum usitatissimum*).—The plants grew fairly well; but they were very short and bushy, even though the seed had been sown very thickly. It is the usual practice in this country to sow linseed for the seed, rather than for fibre; hence, it is customary to sow thinly. This secures a better crop of seed, though it spoils all chance of any good fibre being produced, probably, if the indigenous seed was sown successively for several seasons, specially in view to producing tall branchless plants, this result might be obtained. At any rate the experiment will be tried at the farm. The small plot gave an outturn of seed at the rate of 302 lb. per acre

73. (*Malachra Rotundifolia*).—Though the plants were healthy, they were very small and so branched as to be of no use for fibre.

74. INTRODUCED AND OTHER TREES.—The following data, regarding the condition and progress of different trees, at the experimental grounds, may be of interest:—

Botanical Name.	Common Name.	Number of Specimen.	Place from which the Seed or Specimen was received.	Height of the Tallest Specimen.	Diamter of spread of Branches.	Age of the Specimen.	Remarks.
				FT.	FT.	YS. MS.	
Morus Indica	Mulberry plants.	7	Bangalore.	16	18	3 7	Began to bear last year.
Psidium pomiferum ..	Graft guava ..	10	Do.	10	12	3 7	Do.
Punica Granatum ..	Pomegranate ..	3	Do.	8	7	3 7	Do.
Achras Sapota ..	Sapota ..	2	Do.	4	2½	3 7	Not bearing; very slow growth.
Aegle Marmelos ..	Bael tree ..	2	Do.	8	3	3 7	Not bearing; grows well.
Anona Squamosa ..	Custard apple ..	2	Do.	6½	4	3 7	Not bearing.
Do. Muricata ..	Sour sop ..	3	Do.	9	7	3 7	Began to bear last year; bore heavily.
Do. Reticulata ..	Sweet sop or Bullock's heart.	1	Do.	10	7	3 7	Began to bear last year.
Citrus Vulgaris ..	....	5	Do.	5	9	3 7	Do. do.; bore heavily.
Bassia Longifolia ..	Bassia tree ..	1	Do.	15	1½	3 7	Not bearing.
Citrus Decumana ..	Shaddock or Pumplemose.	2	Do.	8½	4	3 7	Do.
Do. Medica	Citron ..	2	Do.	2	2	2 5	Do.
Do. Aurantium ..	Sweet orange ..	4	Do.	7	4	3 7	Do.; grows well.
Do. Bergamia ..	Acid lime ..	3	Do.	9	8	3 7	Bearing this year.
Ficus Carica	Fig	1	Do.	8	4	3 7	Bears well; fruits small.

Botanical Name.	Common Name.	Number of Specimens in the Botanical Garden.	Place from which the Specimens or Seed were received.	Height of the tallest Specimen.	Girth of the tallest Specimen.	Age of the Specimens.		Remarks.
						Y.	M.	
Eucalyptus Hemipoya	....	2	Bangalore ..	24′ 1″	15″	3	7	Produces gum.
Do. Paniculata	....	2	Do. ..	26′ 8″	17″	3	7	Partially spoiled by late cyclone.
Do. Teriticormis	Red gum tree ..	11	Australia	27′ 8″	11″	2	1½	The tallest grown Eucalyptus tree.
Do. Citriodosa	Lemon-scented gum .	2	Do.	17′ 7″	8″	2	1½	Produces black gum.
Do. Sidrophlio	....	3	Do.	18′ 7″	7″	2	1½	Bushy in general; red gum.
Do. Hemipoya	....	2	Do.	12′	5″	2	1½	Produces gum.
Do. Rostiata	....	2	Do.	17′ 4″	10″	2	1½	Do.
Do. Rosinifera	....	3	Do.	15′ 9″	11″	2	1½	Do.
Do. Bicolor	....	3	Do.	10′ 4″	6″	2	1½	No gum; bushy growth.
Do. Yellow Mahagony ..	....	3	Do.	5′ 9″	2½″	2	1½	Leaves dark green.
Do. Gonicalyt	....	3	Do.	13′ 4″	7″	2	1½	Produces gum.
Casuarina Muricata	Casuarina ..	80	Bangalore ..	43′ 4″	22″	3	6	
Conocarpus Latifolia	....	6	....	20′ 9″	17½″	3	2	
Hæmatoxylon Campechianum ..	Log wood ..	1	Agri-Horticultural Gardens, Madras.	10′	5″	3	0	
Pongamia Glabra	Pungam tree ..	30	....	21′	23″	5	0	
Terminalia Catappa	Country almond ..	3	Agri-Horticultural Gardens, Madras.	16′	9″	3	0	
Acacia Raspling	....	2	Nilgiri Hills ..	11′ 7″	3½″	2	1½	
Do. Implexa	....	2	Do. ..	4′ 6″	2½″	2	1½	
Do. Jaligna	....	4	Do. ..	11′ 3″	8″	2	1½	Very much branched.
Do. Longifolia	....	1	Do. ..	6′ 7½″	3″	2	1½	
De. Proslanthera	....	12	Do. ..	8′ 2″	4″	2	1½	
Cæsalpinia Coriaria	American Sumach ..	17	Bangalore ..	15′ 9½″	8″	2	1½	Yielded 13 lb. of seed in the year.
Pterocarpus Marsupium	Kino tree	3	Madras Horticultural Gardens.	14′ 2″	9″	3	0	
Sterculia Alata	Winged Sterculia ..	2	....	4′ 4″	5″	3	0	
Swietenia Mahagony	Mahagony tree ..	3	Australia	14′ 4″	9″	4	0	
Dalbergia Frondosa	....	4	....	14′ 10″	12″	3	0	
Tectona Grandis	Teakwood tree ..	4	Bangalore ..	19′ 4″	11″	3	0	Damaged by cyclone.
Eriodendron Anfractuosum ..	White cotton tree ..	6	Do. ..	20′ 4″	21″	3	0	
Pithecolobium Saman	Rain tree	13	Madras Horticultural Gardens.	23′ 8″	30″	3	4	Flowered for the first time this year; closes its leaves at 4-30 to 5 P.M., and opens at 6-30 to 7 A.M., in April.
Ficus Elastica	India rubber tree ..	1	....	3′ 3″	2″	1	2	

75. THE SOY BEAN—*Glycine Soja* (*Soja Hispida*).—This is the ordinary China bean, a plant largely cultivated in China and Japan. The bean affords a valuable oil, and the residue, after crushing a valuable cattle food, while the green pod is made into the well-known sauce. The Society of Arts Journal, of August last, having drawn attention to some experiments made on the Continent of Europe in feeding stock with this valuable bean, it was thought advisable to obtain from the hotter part of China a supply of the seed, in view to making a small experiment in its culture at Saidápet. Messrs. Jardine, Matheson & Co., the eminent merchants of Hongkong, were good enough to procure, and forward to Saidápet, a small supply of the seed. It arrived safely, and on the 4th January 1882, a plot of 72 square yards was planted with the seed. It germinated well and produced healthy plants but only about 1½ ft. in height; some of which were well covered with pods, but the majority, did not thrive, apparently owing to the excessive heat of the weather at the time. Of course, it was far from a favorable time of the year, at which to sow the crop, but it was thought better to sow the seed, with the chances of adverse weather, rather than, to keep it over until the following cold season, as, experience had shown, that the larger leguminous seeds so readily lose their vitality, when exposed to a high temperature. The crop was gathered in April 1882, the yield per acre was 280 lb. only.

76. The plant, and the seed, much resembled Mochacottay (*Lablab Vulgaris*), but the Soy bean grows more uprightly, and the leaf is slightly different, while it has no tendrils. Mr. Wilkins has furnished the following statement, showing the differences between Lablab vulgaris and, the Soy bean :—

Lablab Vulgare.—Larger plant, less hairy than Dolichos Soja, twining.

Pods horizontal. Broadly scimitar-shaped, gibbous below apex, and ending abruptly in a straight or recurved cuspidate point. Three to 5-seeded seed, with raphe very marked, seed larger, longitudinally oval, compressed.

Dolichos Soja.—Plant small, not twining, leaves *very hairy*, small. Pods pendulous, narrower, 2-seeded, often 3-seeded, seeds smaller, inclined to be round, raphe indistinct.

77. The following analysis, published by the Society of Arts, shows that the bean is, a very nutritious one :—

Constituents.	P.C.
Water	15·20
Fat	16·21
Protein compounds	28·63
Non-nitrogenous extractive matter	30·84
Fibre	4·38
Mineral matter	4·74
Total ...	1 0·00

78. It would be a very great advantage, in this part of India, if a good variety of bean, could be introduced into general cultivation, for human food. The people of South India, depend largely on a vegetable diet, generally of a very inferior kind, and the addition of a good pulse to their daily food, would go a long way towards supplying the albuminoids which they so greatly require, and which, they at present get in such small quantities.

79. PANICUM CAPPILLARE (*Giant Grass*).—This grass having attracted some attention in Java, it was thought that its introduction into this country might be advisable. Before taking steps to introduce it, enquiries were instituted regarding its history and character. The result of these enquiries was not satisfactory, as will be seen from the following extracts from reports submitted :—

"It is not an Asiatic species, but is indigenous in the region of country lying to the west of the Missouri River, United States, where it is found widely spread. Referring to this grass, in his report for the year 1870, the United States Commissioner of Agriculture wrote : " The yearly pioneer, however, has already learned how soon the good native grasses are destroyed by the

clipping and treading of domestic animals, and he sees with regret their places immediately occupied by * * * *Panicum Cappillare*, *Panicum Sanguinale*, &c., &c., worthless weeds and grasses that occupy the soil to the exclusion of every profitable production."

From this quotation, it would appear that the grass has not a good reputation in the country where it is indigenous. Of course, it is possible, the grass may have since been improved, by undergoing special cultivation and treatment. The following are extracts from letters from Java, and the United States, referring to this grass;—

"As to the '*Panicum Cappillare*' you want my information about, I can only tell you that it has been introduced in Java by a private planter, but I do not know in how far the results of its cultivation answer to the great expectations this gentleman had of its qualities as a fodder plant.

"This is one of the many varieties of panic grasses found wild in this country, none of which seem to be thought worthy of cultivation; however, this special variety is not cultivated, and this seed cannot be procured."

MANURES.

80. The manures used during the year were, oil-cake, paddy husks, ashes, farm-manure, slaughter-house refuse, indigo-vat refuse, &c.

81. A compost of oil cake, paddy husks and ashes, was applied with good results as, a top dressing to the paddy land. The manure most largely used was farm-manure, made, as usual, in the loose boxes; it remained undisturbed until required in the fields. The loose-box system, continues to afford most satisfactory results, both as regards the health of the stock, and the quality of the manure obtained. There can be no doubt, but that this system of collecting and preparing manure, is well adapted to the requirements of South Indian farming.

82. Sheep manure was collected in the sheds where the sheep are confined at night; a layer of sand collected the urine, and this, with the solid manure, form an excellent top-dressing for grass and other crops.

83. Some fields were manured directly by sheep, by penning them on the land. To ascertain the effects of sheep-folding in comparison with the fertilizing effect of indigo-vat refuse, the following experiment was made:—Field No. 29 was divided into two plots; one plot measured ·84 acre, and the other ·94 acre. The former was manured, by folding seventy-six sheep on it for twenty-two nights, which was equal to about 2,000 sheep, one night, per acre; the sheep had a daily allowance of ½ lb. of oil cake, per head, and were grazed during the day. The other plot was manured with indigo refuse at the rate of 3 tons per acre. The land was sown with paddy, and the following are the results:—

Manure applied.	Area of Plot.	Outturn.			
		Per of Plot.		Per Acre.	
	ACS.	LB. GRAIN.	LB. STRAW.	LB. GRAIN.	LB. STRAW.
Plot manured by sheep folding	·84	991	2,985	1,180	3,554
Do. with indigo refuse	·94	1,299	5,208	1,382	5,540

The indigo refuse produced the best crop; probably much of this result is to be attributed to the physical action of the organic matter; still, indigo refuse is undoubtedly a valuable manuring agent when, it has been protected from the weather.

84. To test the efficacy of lime, as a manure for indigo on the farm land, the following experiment was made. The western portion of Field No. 15, about 3 acres in extent, was divided into three plots, one plot was unmanured, one plot received 17 parahs of lime, and the other plot was manured with 34 parahs of lime; a parah contains 4,000 cubic inches. The lime was slacked before being applied. The following statement shows the results:—

Manures.	First Cutting.		Second Cutting.		Third Cutting.		Total Outturn.	
	Bundles.	Weight.	Bundles.	Weight.	Bundles.	Weight.	Bundles.	Weight.
		LB.		LB.		LB.		LB.
No manure	40	2,240	17	874	31·5	1,718	88·5	4,832
8½ Parahs of lime ..	43	2,408	22	1,186	44	2,528	109	6,122
17 Do. do. ..	61	3,416	20	1,032	44·5	2,625	125·5	7,073

85. To ascertain the manurial value of the slaughter-house refuse, compared with that of farm manure for cotton, the following experiment was made. Field No. 10, west, was divided into two equal plots, one of these plots was manured with 8 tons of farm manure, and the other with 8 tons of slaughter-house refuse, and the whole of the land was sown with cotton. The next table shows the results :—

Months.	10 A. North.	10 A. South.
	8 Tons Farm Manure.	8 Tons Slaughter-house Refuse.
	Cotton-in-seed lbs.	Cotton-in-seed lbs.
March 1881	16	13 50
April ,, ...	6·50	8·25
May ,, ...	49·75	29·50
June ,, ...	97·50	74·25
July ,, ...	35·	41·75
August ,, ...	54·	14·25
September ,, ...	18·75	11
October ,, ...	..	6·25
	277·50	198·75

86. The slaughter-house refuse consisted chiefly of rejected offal, blood, &c., largely mixed with wood ashes ; the refuse is collected daily, and, is thrown into a pit and covered with wood ashes ; after being in the pit for about 3 months, the manure is thoroughly deodorized, and is then in a fine dry powdery condition.

87. Gypsum (sulphate of lime) was tried as a manure, in a small experiment with Minnesota Amber sugar-cane. This manure, under the name of "plaster," is largely used in the United States, for Sorghum crops. It is difficult to procure gypsum near Madras, and it costs from 10 to 15 rupees per ton. There are no natural deposits of gypsum, it is believed, nearer Madras than Trichinopoly. The special point, under investigation in this experiment, was the effect that gypsum would produce in the amount of crystallizable sugar in the juice of the plants. The cultivation results of the plots have already been noticed under "Crops." The following extracts refer to the experiments made in preparing jaggery from plants raised with gypsum, and, without it :—

"Not having been able to obtain suitable apparatus for making sugar, I confined the experiment to the manufacture of jaggery. The results of the various determinations are tabulated below :—

Number of Experiment.	Date of Experiment.	Number of Canes crushed.	Weight of Canes.	Weight of Heads.	Yield of Juice.			Yield of Jaggery.			Remarks.
					Volume.	Weight.	Percentage Weight of the Cane.	Weight.	Percentage of the Juice.	Percentage of the Canes.	
	1881.		LB.	LB.	*MRS. OLLS.	LB.		LB. OZ.			
1	18th October.	50	47	4	4 3	17¾	37·76	1 6	7·74	2·92	Soil dressed with gypsum.
2	18th ,,	50	49	4	5 0	20¼	41·32	1 12	8·64	3·57	
3	22nd ,,	50	49	5	4 1½	17¼	35·20	2 3	12·68	4·46	Soil dressed with gypsum.
4	22nd ,,	50	45	4¾	4 0	16	35· 5	2 5	14·45	5·13	
5	28th ,,	66	50	..	6 1	24½	49· 0	3 0	12·24	6· 0	
6	28th ,,	82	50	..	6 5	26	52· 0	3 1	11·77	6·12	

* A Madras measure contains 100 cubic inches.

"Mr. Hamilton, F.C.S., Chemical Lecturer in the Agricultural College, was good enough to make analyses of the jaggery produced. The following is his report :—

'REPORT of Analysis of three Samples of Sorghum Jaggery, the produce of the Government Saidápet Farm.

—	Amber Cane Jaggery from Plants grown without Gypsum.	Amber Cane Jaggery from Plants grown without Gypsum.	Amber Cane Jaggery from plants grown with Gypsum.
	1	2	3
	PER CENT.	PER CENT.	PER CENT.
Crystallizable sugar	68·98	65·91	65·91
Non-crystallizable sugar	15·75	14·24	14·24
Water and extractives	15·27	19·85	19·85
	100·00	100·00	100·00

'REMARKS.—The samples are of varying appearance. No. 1 is more consistent and lighter in color than the other two; the crystallizable sugar in this sample is in a finely granular condition. Nos. 2 and 3 are of a darker color; the crystals are more abundant, and are deposited in the bottom of the vessel beneath the dark supernatant syrup. No. 3 is somewhat darker from the presence of caramel due to slight burning.

'The examination of the jaggery was made with an average sample prepared by intimately mixing the syrup and sugar in each vessel.

'Taking into consideration that the process employed on the Farm is of the simplest description, the results are very favorable. The quantity of non-crystallizable sugar is high in all the samples, but this may be due to some defect in the preparation of the syrup by which the crystallizable sugar had suffered change by 'inversion.' The proportion of glucose in the freshly expressed juice is small, as I have ascertained. If, therefore, precautions were taken to avoid fermentation, there is no doubt that a larger outturn of crystallizable sugar would result. The juice decomposes quickly when exposed to the action of the air.

'The quantity of the jaggery was determined by Fehling's gravimetric copper process: this method was selected owing to its general adoption by Chemists in the United States, and will be useful for comparison with the published analyses of sugars from American-grown cane.

'If the necessary means for controlling the fire were available in boiling the clarified juice, the syrups could doubtless have been submitted to further concentration; the presence of the water showing a relative decrease in the three samples in the proportion of crystallizable sugar.

No. 1 shows an apparent increase in the total quantity of sugars, which can be accounted for by the greater concentration of the syrup in this case. The uniformity in the results obtained from Nos. 2 and 3 is striking. The manure used does not appear to have influenced the production of sugar.'"

The juice on leaving the mill contains glucose, besides cane sugar, and, an acid. When the canes are not sufficiently ripe, there appears to be more glucose present. Lime was used to neutralize the acid, but even in neutral solutions of juice, fermentation converts cane sugar into glucose—a result also produced by concentrating the juice in open pans. Another small experiment was made in dressing land with gypsum, in view to increasing the percentage of sugar in Maize plants. These cropping results also, have been referred to. The following account, refers to the jaggery-manufacturing portion, of the experiment:—

Number of Experiment.	Crop.	Date of Experiment.	Number of Canes crushed.	Weight of Straw.	Weight of Canes after stripping and topping.	Yield of Juice.			Yield of Jaggery.		
						Volume.	Weight.	Percentage Weight of the Canes.	Jaggery.	Percentage of the Juice.	Percentage of Straw.
				LB.	LB.	MS. OL.	LB.		LB.		
1	Hawkesbury River Maize..	27th Dec. 1881 ..	100	80	54	5 0	21	26·25	2·25	10·7	2·81
2	Do. do. ..	27th ,, ,, ..	200	175	112	10 4	43½	24·85	5·50	12·6	3·14*
3	Clarence River Maize ..	27th ,, ,, ..	100	94	63	5 2	21½	22·87	2·50	11·6	2·66
4	Do. do. ..	28th ,, ,, ..	100	95	64	5 6	25	26·31	3·25	13·0	3·42*

* Manured with gypsum.

" It will be observed that the yield of jaggery on the average is about 3 per cent. of the weight of the straw. Mr. Hamilton, F. C. S., was good enough to make an analysis of the jaggery produced. The following is his report:—

" Report of Analysis of four Samples of Maize Syrup, the produce of the Government Saidápet Farm.

—	Clarence River Maize.		Hawkesbury River Maize.	
	Manured with Oil Cake.	Manured with Oil Cake and Gypsum.	Manured with Oil Cake.	Manured with Oil Cake and Gypsum.
	1	2	3	4
	PER CENT.	PER CENT.	PER CENT.	PER CENT.
Crystallizable Sugar	34·99	29·61	28·93	31·40
Non-crystallizable Sugar	11·46	25·22	17·19	18·34

' The large amount of water in Nos. 1 and 3 will account for the smaller quantity of total saccharine matter. None of the samples have the consistence of jaggery; they are syrups of varying density, Nos. 2 and 4 being more concentrated. The higher percentage of non-crystallizable sugar in No. 2 points to some defect in preparation—either that the juice was not immediately boiled, or that the prolonged boiling of maize juice in open pans favors the conversion of the crystallizable sugar into glucose.'

It will be seen that the jaggery from the " Clarence River Maize " is richer in crystallizable sugar than that of the other variety. It is difficult to explain why the gypsum-manured portion of the plot yielded a smaller percentage of crystallizable sugar, for it is generally supposed that gypsum facilitates the formation of this kind of sugar. However, on both plots, unlike in the Amber sugar cane experiment, the gypsum increased considerably the total yield of sugar. In the case of the " Clarence Maize," the increase was nearly 10 per cent. As far as the data afforded by these experiments, enable an opinion to be formed, it does not appear that it will pay to make jaggery from the juice of the maize plant unless, it be grown on much superior soils than at the farm. The subject, however, is one well worth further investigation both here

and elsewhere, as in the United States it has been found highly profitable to extract the sugar of the maize plant. The presence of so much sugar, in the straw of maize, indicates the high value of this straw for feeding stock.

88. The following experiment, was made to ascertain the effects of lime on the arrowroot plant, as regards its yield of starch :—

Plot C was dressed with 30 lb. of slacked lime, equal to an application of 2,017 lb. per acre ; the other two plots, received no lime. The following, are the results :—

Plot A.	Area.	Actual Outturn.		Per Acre.	
		Tubers.	Starch.	Tubers.	Starch.
	SQ. YD.	LB.	LB.	LB.	LB.
2 (A)	72	82	4	5,512	269
3 (B)	72	161	6	10,823	403
4 (C)	72	158	18·50	10,621	1,244

The tubers in Plots A and B, were very small, and much diseased, whereas those in Plot C, were of a fair size and generally, sound. As the soils were identical, and, the treatment similar in every respect, the great superiority of the crop of Plot C can, therefore, be attributed only to the effects of the lime.

89. The manuring experiments in Field No. 8 were continued on eight of the plots ; those on the other plots, had to be abandoned, from the great want of uniformity in the soils, chiefly, as regards their physical condition—drawbacks, not disclosed fully, until the long drought of the past season. Each plot, measures one-tenth of an acre, and each, is separated from the other, by a foot-path.

90. Since the year 1880, the manures used, have been those only that can readily be procured in the neighbourhood of the farm, and the cost, per acre, has been limited to Rs. 5, excepting in the case of farm manure, which, was employed as a standard, for comparison. It would, perhaps, have been better, from the first, to have confined the experiments to one variety of sorghum ; and, in future, the yellow variety only, which is the hardiest of the family, will be sown. The crop of the last season was sown on the 7th September, the seed was very good, 90 per cent. being vital. It germinated freely, and produced a uniform covering of plants. On the 4th of January, the crop was harvested, and from the eight plots 616 lb. of grain and 5,992 lb. straw were obtained, equal to 770 lb. of grain, and 7,490 lb. of straw, per acre.

91. The next statement, shows the results of the cropping of the two years, over which, the experiment has extended ;—

FIRST YEAR (1880-81).						SECOND YEAR (1881-82).						TOTAL OUTTURN OF EACH PLOT PER ACRE IN THE 2 YEARS OVER WHICH THE EXPERIMENTS HAVE EXTENDED.		VALUE OF PRODUCE PER ACRE.		
CROP—SORGHUM VULGARE.						CROP—SORGHUM SACCHARATUM.										
Plot.	Manure used on each Plot.	Outturn.				Manure used on each Plot.	Outturn.									
		Per Plot.		Per Acre.			Per Plot.		Per Acre.							
		Grain.	Straw.	Grain.	Straw.		Grain.	Straw.	Grain.	Straw.		Grain.	Straw.	Grain.	Straw.	Total.
		LB.	LB.	LB.	LB.		LB.	LB.	LB.	LB.		LB.	LB.	RS.	RS.	RS.
3	1 ton Farm manure	95	531	950	5,310	No manure	60	840	600	8,400		1,550	13,710	31·0	45·7	76·7
4	No manure	54	291	545	2,915	10 cwts. Farm manure	99	672	990	6,720		1,535	9,635	30·7	32·1	62·8
5	2,860 lb. Ashes	51	238	515	2,385	No manure	84	840	840	8,400		1,355	10,785	27·1	35·2	62·3
6	No manure	57	281	570	2,810	66½ lb. Oil cake	75	840	750	8,400		1,320	11,210	26·4	37·3	63·7
7	211 lb. Slacked lime	48	210	485	2,100	No manure	61	728	610	7,280		1,095	9,380	21·9	31·2	53·1
8	No manure	47	218	475	2,185	1 ton Farm manure	99	896	990	8,960		1,565	11,145	31·3	37·1	68·4
9	50 lb. Oil cake	84	361	845	3,615	No manure	80	616	800	6,160		1,645	9,775	32·9	32·5	65·4
10	No manure	34	191	345	1,915	Do.	58	560	580	5,600		925	7,515	18·5	25·0	43·5
	Average Yield ..	59	290	591	2,904	Average Yield ..	77	749	770	7,490		..	..	..	..	..

It will be noticed that the highest money value of produce, is that of plot 3 manured with Farm manure at the rate of 10 tons per acre. The highest outturn of grain, however, was obtained on plot 9, manured with oil-cake, and yet, this manure contained only about half as much nitrogen as, the Farm manure was supposed to contain. It will be observed also that, contrary to usual experience, the ashes gave a larger return in the second year, than in the first. They were a mixture of the ashes of paddy husks, cow-dung, and of wood. The low outturn from lime, may be due to the great deficiency of organic matter in the soil, and, to the fact that the soil is a very sandy one; lime, usually, has more effect on clay soils, than on sands, especially clay soils which, contain a fair amount of organic matter.

92. Assuming that in the two years, the manures applied in 1881, to plots 3, 5, 7 and 9 were all used up, it would appear that the manural value of the Farm manure, compared, with that of ashes, lime, and oil-cake, at the prices at which they are procurable at the Farm, is only Annas 10 per ton, a price much lower than that, at which it has hitherto been valued. The Farm manure may, however, be more lasting in its manural effects, than the other substances experimented with, and on this point, the next year's crop will throw light, as the plots will be cropped without manure.

93. To ascertain, whether the growth of weeds, of any special variety, was encouraged, by any of the manures used in the experiments, the ground was examined by Mr. Wilkins after the removal of the last crop, and he, has been good enough to furnish the following statement:—

	10	9	8	7	6	5	4	3
Weeds Number.	Very few.	Few.	Overgrown with weeds.	Very few.	Few.	Few.	Very few.	Very few.
Weeds Varieties	* Poa plumosa. † Ipomœa Pestigridis. ‡ Cyperus rotundus. § Commelina. Bengalensis.	* Cynodon Dactylon. ‡ Cyperus rotundus. § Commelina. Bengalensis.	* Cynodon Dactylon. ‡ Cyperus rotundus. § Commelina. Bengalensis.	* Poa plumosa.. ‡ Ipomœa Pestigridis. ‡ Cyperus rotundus. § Commelina. Bengalensis.	* Cynodon Dactylon. ‡ Cyperus rotundus. ‖ Eclipta erecta. ¶ Lenca Indica.	* Poa plumosa. † Ipomœa Pestigridis. ‡ Cyperus rotundus. § Commelina. Bengalensis.	† Poa plumosa. ‡ Ipomœa Pestigridis. ‡ Cyperus rotundus. § Commelina. Bengalensis.	‡ Cyperus rotundus. § Commelina. Bengalensis.

Natural Order.

* Graminaceæ. | † Convolvulaceæ. | ‡ Cyperaceæ. | § Commelinaceæ. | ‖ Compositæ. | ¶ Labiateæ.

It will be observed that the oil-cake encouraged the growth of Hariali grass (Cynodon Dactylon); a hint for grass growers.

94. The experiments, referred to at paragraph 57, of the last report, were continued during the past year. It was found necessary to ascertain the manural value of paddy straw, in connection with these experiments, and two of the plots were accordingly manured with 185 lb. of paddy straw; while, as paddy husks are used in preparing the bratties, from which the cow-dung ashes were made, an equivalent amount of husk ashes has been added to the plots manured with box manure, solid dung, and paddy straw. The crop grown was *Sorghum Kaffrarium*, the drought in October nearly ruined it, resulting in a serious attack of "rust" which, occurring when the plants were in flower, proved most disastrous.

95. The great uncertainty of the weather in this part of India, is a very serious difficulty in the way of field experiments, conducted without the aid of irrigation water, over a series of years; which, a single bad season may bring to an untimely end. On the other hand, manural experiments conducted on irrigated land, are liable to serious errors, by accident, or carelessness, in the application of the water. The experiments will, be persevered in, for though, their results are now, apparently, very conflicting, they may become intelligible when more data are available on which to form a conclusion; and, probably, the character of the season has much to do with these results. The manures used, were made by 3 pairs of cattle, worked, and fed, alike. The next statement, shows the amount of manure of each kind, obtained in each year:—

1880-81.

Description of Manure.	Number of Hours during which the Cattle were tied up.	Weight of each pair of Bullocks.	Box Manure.		Solid Excrements.		Ash of Cattle-dung.		Food of the Animals.		
			Straw used for Bedding.	Weight of Box Manure obtained.	Weight of the fresh solid Excrements.	Solid Excrements finally available.	Indigo Husk used for Bratties.	Weight of Ashes obtained.	Cake.	Green food.	Straw.
	HOURS.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.
A. Box manure	1,051	1,126	545	1,716	..	..	..	..	182	2,275	2,275
B. Solid excrements ..	1,049	1,135	..	..	2,171	784	..	..	182	2,275	2,275
C. Ashes	1,051	1,115	..	..	2,288	..	90	240	182	2,275	2,275

1881-82.

A. Box manure	1,209	1,219	185	1,848	..	..	..	..	320	2,731	1,335
B. Solid excrements ..	1,195	1,281	..	..	1,653	676	..	..	320	2,931	1,335
C. Ashes	1,200	1,252	..	..	1,636	..	56	171	320	2,831	1,335

			LB.
Average outturn of manure	From one pair of cattle during fifty two days.	In Farm manure	1,848
		Solid dung	1,653
		Ashes	171

The pairs of cattle, were recognised as, A, B, and C. The excrements of A, solid and liquid, were collected with the litter, in the form of box manure. As regards B, only solid excrements were collected, as is the practice amongst the ryots; this was thrown into an open midden quite unprotected from the weather. While the solid excrements of C, were daily collected, and made into bratties, and these, were afterwards burnt into ashes.

96. The results of the two years' experiments, are tabulated on the other side:—

1880-81.

Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.
Manure—856 lb. box manure.. ..	Manure—None	Manure—392 lb. solid excrements ..	Manure—None	Manure—120 lb. dung ashes.
Produce .. { Grain .. 25 lb. Straw .. 189 ,,	Produce .. { Grain .. 14½ lb. Straw .. 125 ,,	Produce .. { Grain .. 28½ lb. Straw .. 193 ,,	Produce .. { Grain .. 15¾ lb. Straw .. 168 ,,	Produce .. { Grain .. 18¾ lb. Straw .. 201 ,,

Plot 12.	Plot 11.	Plot 10.	Plot 9.	Plot 8.	Plot 7.
Manure—856 lb. box manure ..	Manure—None	Manure—392 lb. solid excrements.	Manure—None	Manure—120 lb. dung ashes ..	Manure—None.
Produce.. { Grain .. 24¾ lb. Straw .. 172 ,,	Produce.. { Grain .. 19 lb. Straw .. 149 ,,	Produce.. { Grain .. 28½ lb. Straw .. 196 ,,	Produce.. { Grain .. 14¼ lb. Straw .. 170 ,,	Produce.. { Grain .. 23½ lb. Straw .. 198 ,,	Produce.. { Grain .. 12½lb. Straw .. 177 ,,

1881-82.

Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.	Plot 6.
Manure—924 lb. box manure and 9 lb. husk ashes.	Manure—None.	Manure—338 lb. solid excrements and 9 lb. husk ashes.	Manure—92½ lb. paddy straw and 9 lb. husk ashes.	Manure—82½ bratty ashes ..	Manure—None.
Produce.. { Grain .. 12 lb. Straw .. 201 ,,	Produce.. { Grain .. 3 lb. Straw .. 75 ,,	Produce.. { Grain .. 6¾ lb. Straw .. 125 ,,	Produce.. { Grain .. 10½ lb. Straw .. 136 ,,	Produce .. { Grain .. 9 lb. Straw .. 136 ,,	Produce.. { Grain .. 5½ lb. Straw .. 110 ,,

Plot 12.	Plot 11.	Plot 10.	Plot 9.	Plot 8.	Plot 7.
Manure—924 lb. box manure and 9 lb. husk ashes.	Manure—None	Manure—338 lb. solid excrements and 9 lb. husk ashes.	Manure—None	Manure—85½ lb. bratty ashes ..	Manure—92½ lb. paddy straw and 9 lb. husk ashes.
Produce.. { Grain .. 6 lb. Straw .. 139 ,,	Produce.. { Grain .. 5½ lb. Straw .. 119 ,,	Produce.. { Grain .. 6¾ lb. Straw .. 143 ,,	Produce.. { Grain .. 9 lb. Straw .. 164 ,,	Produce.. { Grain .. 9½ lb. Straw .. 189 ,,	Produce.. { Grain .. 9½ lb. Straw .. 168 ,,

The results of plot 6, were in the first year rejected, the previous cultivation having changed greatly the state of the soil of this plot.

97. *Green Manuring.*—Further experience shows, that in dealing with the very sandy soils of the Farm, "Green Manuring" is, perhaps, the most successful means of improvement. The practice, now adopted, is, in the hot season, when the weather is showery, to sow with horse-gram a large area of the land without crop, the produce, either to be grazed by sheep folded on the land, or ploughed into the ground as green manure. There is, in most years, enough rain in June and July, to admit of this practice being carried out, though not enough for a regular crop to be matured, and secured, before the north-east rains set in. During the long preceding dry season, nitrification occurs in these soils to a very considerable extent, for though they are deficient in lime, they contain an abundance of soda, and this base, is utilized in forming nitrates, and these being so very soluble would, if left in the land be washed out, by the heavy rain of the monsoon; but when horse-gram is sown on the land, it greedily feeds on these nitrates, which, becoming worked up in organic combinations, are stored safely against removal by heavy rain. There must, be an enormous waste of nitrates in this country when, after a very long dry season, heavy rains occur, as at the beginning of a monsoon. This, shows the necessity for getting in the seed, as early as possible at seed time, before the setting in of the heavy monsoon rains, in order that the young plants may take up the nitrates and hold them safe. It has, in Europe, been repeatedly shown that during a year, as much as 40 lb. of nitrates, per acre, may be formed and stored in a good properly worked soil. Nitrates are so extremely valuable, the careful farmer should use every endeavour to utilize them thoroughly; and, the plan before suggested is, perhaps, the best that can be adopted.

98. *Germination of Cocoanuts.*—Attention having been recently directed, in several scientific journals, to the possibility of hastening the germination of hard husked seeds, by steeping them in solutions of different salts and acids, especially, in solutions of sulphuric acid, an experiment was made to test whether the germination of cocoanuts could thus be hastened. For the experiment ten fresh cocoanuts were taken, and they were treated as follows :—

Experiment.

No. 1.—Two nuts, steeped in water.
„ 2.— „ „ with 5 P.C. of sulphuric acid.
„ 3.— „ „ with 10 P.C. of „
„ 4.— „ „ with 15 P.C. of „
„ 5.— „ not steeped.

The nuts were kept in the water, and solutions, for five days. On the 1st of December last, the whole of the nuts were planted in a piece of suitable soil. The soil was watered when necessary. On the 12th of March one of the nuts sent up a vigorous shoot, but the others having failed to send up shoots, they were all dug up on the 31st of March, when they were found in the condition stated below :—

Experiment.

No. 1.—Both nuts had germinated well, and produced vigorous shoots.
„ 2.—One nut had germinated, the other was rotten.
„ 3.—Neither of the nuts had germinated, but both were in good order.
„ 4.—One of the nuts was just commencing to germinate, both were in good order.
„ 5.—One of the nuts was just commencing to germinate, both were in good order.

99. As far as can be judged from this single experiment, steeping in acid solutions, seems to retard, rather than to facilitate the germination of cocoanuts, while steeping in pure water hastens germination. The subject will, however, receive further attention, and other experiments, will be instituted.

100. *Great variation in the produce of land.*—Few persons not practically conversant with agriculture, have any idea how the produce of the different parts of a field may differ in amount. Some agricultural experimentalists, instead of weighing and measuring the whole of the produce of a plot or field, select what they suppose to be an average portion and weigh or measure that only, the result being accepted as, the basis for calculating the outturn of the whole plot, or field. This course is, frequently, an erroneous one, for few men, even trained agriculturists, can select a few square yards of crop, which is, really, an average representative portion of the whole of a field, unless it is of very moderate dimensions.

101. In preparing a piece of land for future experimental crops, it was necessary to determine the natural productiveness of the soil. The field was divided into 14 plots, each of $\frac{1}{160}$th of an acre. These plots were ploughed, and on the 29th December 1881, the whole were sown with horse-gram (*Dolichos uniflorus*). The land had for four or five years previously been under grass. No manure was applied. The eastern portion of the field, comprising plots 5, 6, 7 and 10, 9, 8 is somewhat lower and, not so well drained, as the remainder of the field, and on this portion, the natural grasses had not grown so well as elsewhere. The pulse germinated well, and over the whole field the growth appeared to be very uniform, and this, continued until about the middle of March when the crop on the eastern side of the field became decidedly inferior, to that on the western side. The crop, was cut on 11th April 1882. Before cutting, each plot was sub-divided into six plots, each having an area of $\frac{1}{960}$th of an acre, and the produce of each of these minor plots, was separately determined, first, when the green plant was cut, next, after thrashing out the pulse. On looking over the following table, it will be observed how widely the outturn varied, in different parts of the field. From an ordinary inspection, before commencing harvesting operations, it appeared that the produce on plots 1, 2 and 14, 13, 12 was very uniform over the whole, but the outturn figures show that, there was a very considerable difference in the outturn of different parts of these plots, the green plant having varied from 2,880 lb., to 8,520 lb. per acre; while, the pulse, varied from 150 lb. to 480 lb. per acre.

102. It is probable that had smaller areas been taken, even greater variations in the outturn, would have been discovered. It is scarcely likely, that any one would have made the mistake of taking any part of the eastern portion of the field as, representing the average of the whole field, at any rate not when the crop was ready for cutting; but, it was almost impossible to discern any difference in the crop, on the five plots above noticed. These results, deserve the serious attention of those whose duty it is, to determine the yield of land, for purposes of assessment; it is a duty, which requires great personal knowledge, and, should not be entrusted to any one without a considerable agricultural experience.

EXPERIMENTAL FIELD No. 7.

NORTH.

Area of each plot 1 *acre.*

PLOT No. 1.		PLOT No. 2.		PLOT No. 3.		PLOT No. 4.		PLOT No. 5.		PLOT No. 6.		PLOT No. 7.	
1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.
Green plants ... 48	Green plants ... 95	Green plants... 142	Green plants ... 132	Green plants ... 98	Green plants ... 80	Green plants ... 112	Green plants ... 116	Green plants ... 76	Green plants ... 75	Green plants ... 68	Green plants ... 60	Green plants ... 100	Green plants ... 100
Dry straw. 37	Dry straw. 36	Dry straw 45·5	Dry straw. 32	Dry straw. 28½	Dry straw. 22	Dry straw. 25½	Dry straw. 30	Dry straw. 17	Dry straw. 16	Dry straw. 18	Dry straw. 15	Dry straw. 32	Dry straw. 24
Pulse ... 7	Pulse ... 7	Pulse ... 5·5	Pulse ... 5	Pulse ... 5	Pulse. ... 5½	Pulse ... 4	Pulse ... 5	Pulse ... 3½	Pulse ... 3	Pulse ... 3¾	Pulse ... 3½	Pulse ... 6	Pulse ... 7
3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.
Green plants ... 151	Green plants... 106	Green plants ... 118	Green plants ... 132	Green plants ... 104	Green plants ... 98	Green plants ... 100	Green plants ... 123	Green plants ... 75	Green plants ... 56	Green plants ... 70	Green plants ... 66	Green plants ... 66	Green plants ... 86
Dry straw. 29½	Dry straw. 25½	Dry straw. 30	Dry straw. 29	Dry straw. 28	Dry straw. 23	Dry straw. 27	Dry straw. 33	Dry straw. 18	Dry straw. 13	Dry straw. 16½	Dry straw. 14½	Dry straw. 14	Dry straw. 17
Pulse ... 5¾	Pulse ... 5¼	Pulse ... 3	Pulse ... 6	Pulse ... 5	Pulse ... 4¾	Pulse ... 3½	Pulse ... 5	Pulse ... 2½	Pulse ... 2½	Pulse ... 2½	Pulse ... 3¼	Pulse ... 2¾	Pulse ... 4½
5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.
Green plants ... 114	Green plants ... 74	Green plants ... 116	Green plants ... 118	Green plants ... 80	Green plants ... 78	Green plants ... 104	Green plants ... 124	Green plants... 151	Green plants ... 88	Green plants ... 44	Green plants ... 18	Green plants ... 14	Green plants ... 32
Dry straw. 31	Dry straw. 21½	Dry staw. 30·2	Dry straw. 34·5	Dry straw. 20	Dry straw. 21	Dry straw. 29½	Dry straw. 32	Dry straw. 42	Dry straw. 8½	Dry straw. 10	Dry straw. 3½	Dry straw. 3	Dry straw. 9
Pulse ... 8	Pulse ... 4	Pulse ... 6·7	Pulse ... 5·2	Pulse ... 3	Pulse ... 2½	Pulse ... 1½	Pulse ... 4	Pulse ... 2¾	Pulse ... 1	Pulse ... 1¼	Pulse ... 1	Pulse ... 1	Pulse ... 1
Produce of No. 1.		*Produce of No.* 2.		*Produce of No.* 3.		*Produce of No.* 4.		*Produce of No.* 5.		*Produce of No.* 6.		*Produce of No.* 7.	
Green plants ... 588 lb.		Green plants ... 758 lb.		Green plants ... 538 lb.		Green plants ... 684 lb.		Green plants ... 471 lb.		Green plants ... 326 lb.		Green plants ... 398 lb.	
Dry straw ... 180½ ,,		Dry straw ... 201·2 ,,		Dry straw ... 142¾ ,,		Dry straw ... 176¾ ,,		Dry straw ... 114½ ,,		Dry straw ... 77¾ ,,		Dry straw ... 99 ,,	
Pulse ... ... 37½ ,,		Pulse ... ... 31·4 ,,		Pulse ... ... 25½ ,,		Pulse ... ... 23 ,,		Pulse ... ... 15½ ,,		Pulse ... ... 15 ,,		Pulse ... ... 22⅝ ,,	

PLOT No. 14.		PLOT No. 13.		PLOT No. 12.		PLOT No. 11.		PLOT No. 10.		PLOT No. 9.		PLOT No. 8.	
1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.	1. LB.	2. LB.
Green plants ... 78	Green plants... 108	Green plants ... 109	Green plants ... 108	Green plants ... 94	Green plants ... 100	Green plants ... 94	Green plants ... 106	Green plants ... 93	Green plants ... 66	Green plants ... 61	Green plants ... 30	Green plants ... 61	Green plants ... 59
Dry straw. 27½	Dry straw. 30	Dry straw. 36½	Dry straw. 28½	Dry straw. 22	Dry straw. 24	Dry straw. 21	Dry straw. 27	Dry straw. 22	Dry straw. 20½	Dry straw. 14	Dry straw. 4¾	Dry straw. 13	Dry straw. 12½
Pulse ... 5½	Pulse ... 6¾	Pulse ... 6½	Pulse ... 4½	Pulse ... 4½	Pulse ... 4	Pulse ... 2½	Pulse ... 2½	Pulse ... 3	Pulse ... 3	Pulse ... 3	Pulse ... 1	Pulse ... $2\frac{1}{16}$	Pulse ... $2\frac{1}{16}$
3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.	3. LB.	4. LB.
Green plants ... 74	Green plants ... 64	Green plants ... 115	Green plants ... 96	Green plants ... 118	Green plants ... 106	Green plants ... 68	Green plants ... 64	Green plants ... 67	Green plants ... 46	Green plants ... 60	Green plants ... 59	Green plants ... 88	Green plants ... 84
Dry straw. 16½	Dry straw. 16½	Dry straw. 37	Dry straw. 31½	Dry straw. 30	Dry straw. 22	Dry straw. 22	Dry straw. 18	Dry straw. 19	Dry straw. 11	Dry straw. 15	Dry straw. 13	Dry straw. 20	Dry straw. 19
Pulse ... 4	Pulse ... 5½	Pulse ... 7	Pulse ... 5⅛	Pulse ... 5	Pulse ... 2½	Pulse ... 2⅛	Pulse ... 2⅛	Pulse ... 4	Pulse ... 3⅛	Pulse ... 1¼	Pulse ... 3½	Pulse ... 5½	Pulse ... 6¼
5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.	5. LB.	6. LB.
Green plants ... 76	Green plants... 107	Green plants ... 89	Green plants ... 88	Green plants... 105	Green plants ... 88	Green plants ... 88	Green plants ... 66	Green plants ... 84	Green plants ... 70	Green plants ... 54	Green plants ... 54	Green plants ... 48	Green plants ... 64
Dry straw. 28	Dry straw. 21½	Dry straw. 25	Dry straw. 26¾	Dry straw. 28½	Dry straw. 19¼	Dry straw. 15	Dry straw. 19	Dry straw. 19	Dry straw. 18⅝	Dry straw. 13	Dry straw. 12	Dry straw. 11	Dry straw. 15
Pulse ... 5	Pulse ... 5½	Pulse ... 3½	Pulse ... 4¼	Pulse ... 4	Pulse ... 2	Pulse ... 1	Pulse ... 1½	Pulse ... 4½	Pulse ... 3	Pulse ... 2¼	Pulse ... 5⅛	Pulse ... 1	Pulse ... 4
Produce of No. 14.		*Produce of No.* 13.		*Produce of No.* 12.		*Produce of No.* 11.		*Produce of No.* 10.		*Produce of No.* 9.		*Produce of No.* 8.	
Green plants ... 507 lb.		Green plants ... 605 lb.		Green plants ... 611 lb.		Green plants ... 486 lb.		Green plants ... 426 lb.		Green plants ... 318 lb.		Green plants ... 404 lb.	
Dry straw ... ... 139¼ ,,		Dry straw ... ... 185½ ,,		Dry straw ... ... 146½ ,,		Dry straw ... ... 122 ,,		Dry straw ... ... 109⅜ ,,		Dry straw ... ... 71¼ ,,		Dry straw ... ... 80½ ,,	
Pulse ... ... 31¾ ,,		Pulse ... ... 31⅛ ,,		Pulse ... ... 22 ,,		Pulse ... ... 12 ,,		Pulse ... ... 20⅝ ,,		Pulse ... ... 16 ,,		Pulse ... ... 20⅞ ,,	

103. As has already been noticed, the object of cropping the land, was simply to determine the natural state of the soil, as regards its capacity to produce a pulse crop. The land, will next be cropped (again without manure) with a cereal crop, and the results, will be determined in the same way as those of the pulse crop. After having raised a pulse, and a cereal crop, on the land, by its own unaided resources, it will be possible to determine something definitely regarding the physical and chemical state of the soil, after which, the experiments to be conducted thereon, will give information of a more intelligible nature, than otherwise, they would. The expenditure of labor, in carrying out an experiment such as this, is great; but is unavoidable, if the results of the experiments are to possess any real value.

LIVE-STOCK.

104. *Cattle.*—There were no deaths from disease, during the year. A number of the cattle were attacked by foot-and-mouth disease, which put them out of condition, but otherwise, no bad consequences resulted. The treatment adopted was the ordinary one, viz., isolation from the healthy stock, the frequent application of astringents to the mouth and, feet, and, frequent washing with carbolic acid. The animals during the attack, had a liberal supply of green food, and were attended by men who, were not permitted to go near the healthy stock.

105. The working cattle were, as usual, kept in loose boxes, and were fed chiefly on green fodder and ground-nut oil cake—a system of feeding which has proved well adapted to their work, which is heavy and continuous.

106. The cost of maintaining a pair of these cattle, in full working condition, may be taken, as below :—

	RS.	A.	P.
Fodder throughout the year, at the rate of 100 lb. a-pair daily, valued at Rs. 2½ a ton	40	11	9
Cake throughout the year, at the rate of 8 lb. a-pair daily, valued at Rs. 6¼ per 500 lb.	36	8	0
Interest on value of the pair of cattle, say, Rs. 100, at 5 per cent.	5	0	0
Deterioration, say, at 10 per cent. per annum, on Rs. 100, the value of the cattle	10	0	0
Shoeing throughout the year, twelve times, at 12 annas ...	9	0	0
Contingencies	3	12	3
Total ...	105	0	0

Estimating that each pair works 16 acres of arable land, the cost, per acre, for bullock labor, amounts to Rs. 6-9-0, per annum. It would be lower, were it not that the seed-sowing season, is such a very short one, a larger force of cattle must be kept, than would be necessary, were it possible to divide the work over a longer period in the year.

107. *Aden Cattle.*—The experiment in breeding Aden stock, is progressing very satisfactorily; the herd now consists of the following animals :—

7	Bulls.
6	Cows.
1	Heifer.
6	Bull-calves.
Total ...	20

Of these, two bulls, three cows and four bull-calves were imported from Aden in October last. They had a rough passage, and arrived in Madras much out of condition. Two cows were shipped at Aden, but one died on the voyage. The two bulls, are inferior to the bull which was previously imported; one of them, is about 2 years, and the other, 5 years, of age. The cows, are similar to the specimen first imported, and are apparently fairly good milkers, one is, however, very old, while another is very young, too young indeed to have had a calf, for some time after her arrival at Saidápet, she was in a very precarious state of health, but has since quite recovered. The four calves are

a fine lot; they have thriven admirably; and, will prove a valuable addition to the herd. There is now a sufficiency of bulls of this valuable breed, to commence breeding operations, and it is proposed, next cold season, to station a few of these bulls in different parts of the country, for use in improving the local dairy breeds.

108. The old Aden cow referred to at paragraph 62 of last report, and in other reports, continued to give milk up to the 22nd of May last; the total produce obtained during this milking period, was 965¼ measures, as shown below:—

	Measures.	
July 1880, from the 23rd	30·9	
August	130·0	
September	133·1	
October	151·2	
November	140·2	
December	140·2	
January 1881	Sick.	Milk thrown away.
February, from the 16th.....	28·9	
March	90·8	
April	90·6	
May, up to 22nd	29·3	
Total ...	965·2	

This is the highest yield, yet obtained from this cow, in a milking period, and the longest period over which she has milked; and during January and a portion of February, when she was attacked by foot-and-mouth disease, the whole of the milk was thrown away and not brought to account. The outturn of milk is higher than is usually obtained from the cows of some of the most highly-esteemed dairy breeds. Taking the yield, during the last milking period, to weigh 3,350 lb., this is, nearly seven times the cow's weight (490 lb). An English milch cow, of one of the larger breeds, will weigh about 1,500 lb., and will not yield more than 6,500 lb. of milk, in the milking period, or only a little over four times the cow's weight. These results, are very surprising, for the cow has, since she came to the Farm, produced six calves, and she had a calf at foot when she was imported. She cannot, therefore, be less than 14 years old—an age at which, in this country, few milk cows yield well. The expenditure incurred for maintaining this cow during her milking period, and until the birth of the last calf, in August, was as follows:—

	Rs.	A.	P.
To 12,060 lb. Green food	40	3	2
„ 902 lb. Ground-nut cake	11	11	7
„ 15 lb. Salt	0	11	0
„ 653 lb. Bran	8	10	10
„ 618 lb. Dholl husk	12	5	9
„ 24 lb. Maize	1	3	2
„ 37½ lb. Cotton-seed	0	15	0
„ 176 lb. Yellow cholum	4	6	5
„ Attendance and Sundries	18	13	5
Total ...	99	0	4

In this table, no charge has been made for the straw used in bedding the cow, because the manure obtained is considered to have a value considerably in excess of that of the straw used. It should also be pointed out that the fodder is charged at its selling price, Rs. 7 per ton, whereas it can be produced for Rs. 2-8-0 per ton at the farm. Besides yielding the milk recorded, the cow reared a fine calf, worth, at the least, Rs. 20. The cost of the 965¼ measures of milk, deducting the value of the calf, was thus Rs. 79-0-4, or 1 anna and 4 pies, per measure. All the milk, produced on the Farm, is sold there, at 2 annas and 8 pies, per measure, to the students. If it was sent to Madras, it would sell for a much higher price, the ordinary price there, being from 3 to 4 annas per measure; and this price, is frequently paid for milk of a very inferior quality. A measure, is equal to about 3 pints. During the four milking periods, beginning with May 1877, for which only we possess full statistics, the yield of milk was as is shown in the next table:—

—	No. of Days between Birth of each Calf or Milking Period.	—	—
		Mrs. Olls.	Gallons.
Milking period beginning May 1877	396	832 3	299·41
Do. do. June 1878	335	694 1	249·68
Do. do. August 1879	426	831 1	298·96
Do. do. July 1880	427	965 2	347·21
Total ..	..	3,322 7	1195·26

109. The cow had another calf at the end of August 1881, and was yielding milk at the close of the year. The following are the registrations :—

	Mrs.	Olls.	Gallons.
August 30th and 31st	4	0	1·43
September	93	4	33·63
October	113	4	40·82
November	103	7	37·36
December	95	6	34·44
January 1882	95	0	34·17
February	79	5	28·64
March	86	5	31·16
Total ...	671	7	241·65

110. A daughter of the cow just referred to, which was born in June 1878, calved in November; and produced a fine bull-calf. The quantity of milk this cow has yielded up to the end of the year is shown in the following table :—

	Mrs.	Olls.	Gallons.
November 1881	44	1	15·87
December	76	4	27·51
January 1882	85	6	30·84
February	75	6	27·25
March	81	6	29·00
Total ...	363	7	130·47

She was fed in the same way as the cow first noticed.

111. A sister of the cow last referred to, born on the 27th August 1879, produced a calf on the 29th of January, when she was under $2\frac{1}{2}$ years of age. Her yield of milk, up to the end of the year is shown below :—

	Mrs.	Olls.	Gallons.
February	37	6	13·58
March	59	2·0	21·31
Total ...	97	0	34·89

112. *Kerry Cow.*—To afford the students, information regarding the characteristics of other breeds of cattle, a Kerry cow, which was offered for sale in the neighbourhood, was purchased. Nothing, with any degree of certainty, could be ascertained regarding her history; but, it is quite certain that she is not pure bred, though she possesses several of the characteristic points of the Kerry breed. She was, apparently, in full milk at the time of purchase, and continued to yield milk until the early part of October, when she became dry. The next table shows the yield of milk :—

	Mrs.	Olls.	Gallons.
June, from 5th to 30th, 1881	92	5	33·32
July	92	4	33·27
August	83	5	30·08
September	71	0	25·54
October	9	5	3·46
Total ...	349	3	125·67

113. The cost of maintaining this cow, until she calved on the 11th of October, was, as shown in the next table :—

	RS.	A.	P.
To 3,960 lb. Green food	13	3	0
„ 310 lb. Ground-nut cake	3	9	10
„ 371½ lb. Bran...	7	6	10
„ 3 lb. Salt	0	2	0
„ 104 lb. Dholl husk	2	1	3
„ Attendance and Sundries	5	6	8
Total ...	31	13	7

The milk cost therefore, 1 anna 6 pies per measure. This cow continued to give milk from the time of calving, until the close of the year. The next table shows the milk obtained :—

	Mrs.	Olls.	Gallons.
October, 11th to 31st	66	5	23·96
November	97	1	34·93
December	98	5	35·47
January 1882	96	1	34·58
February	70	1	25·22
March	74	5	26·84
Total ...	503	2	181·00

The cost of maintaining the cow, during this period, is shown in next table :—

	RS.	A.	P.
To 8,010 lb. Green food	26	11	3
„ 360 lb. Ground-nut cake	4	3	2
„ 539½ lb. Bran	10	12	8
„ 4 lb. Salt	0	3	0
„ 65 lb. Planters' friend	1	10	0
„ 9 lb. Horse gram	0	2	3
„ Attendance and Sundries	6	9	8
Total ...	50	4	0

In this case, the milk cost 1 anna 7 pies, per measure.

114. *Nellore Breed.*—Two cows of this breed were purchased on the 19th of January last. Each was about four years of age, and each had a calf (first) aged about three months. They are good specimens of the breed. They cost Rs. 100 each. The next statement shows the milk, yielded by these cows, up to the close of the year :—

Months.	Grey Cow.		White Cow.	
	MERS.	OLLS.	MERS.	OLLS.
January	42	6	36	1
February	84	1	80	1
March	82	1	86	2
Total ..	209	0	202	4

These cows were fed in the same way as, the Kerry, and Aden cows.

115. The milk produced on the Farm—about 200 gallons a-month—is all sold, as fresh milk, to the students, hence it has not been necessary to make butter. Several small experiments have, however, been made in butter-making, the results of which, are shown in the next table :—

Dairying Experiment.

Date of Churning.	Cow from which the Milk was obtained.	Milk used. Morning Milking.	Milk used. Evening Milking.	Churning took place after Milking Hour.	Butter obtained. First Churning.	Butter obtained. Second Churning.	Butter obtained. Total.	Butter = Percentage of Milk.	Duration of Churning. First Churning.	Duration of Churning. Second Churning.	Amount of Ghee obtained.	Ghee = Percentage of Butter.	Feeding and General Management of the Cows.	Treatment of Milk from leaving the Cow until the Butter was produced.
		OZ.	OZ.	HRS.	OZ.	OZ.	OZ.		MTS.	MTS.	OZ.			
28th April.. ..	Mixture from all cows.	91⅞	..	25	2½	..	2½	2·72	7	..	..	..	All the cows were fed daily with 2½ lb. ground-nut cake, 4 lb. bran and 30lb.¶ of green food, but to Aden and Kerry cow 2½lb. Planters' Friend seed extra and to Sultana I—III and Bonu 2½ lb. horse-gram.	Immediately after milking the milk was poured into a tin can, and 4 or 5 drops of buttermilk were added for each measure of milk.
28th ,, ...	Do.	..	61¼	18	1¼	..	1¼	2·04	7½	..	..	..		
28th ,, ...	Do.	61¼	..	1	1¼	..	1¼	2·04	11	..	..	..		
1st May	Do.	156⅜	..	25	2⅜	1⅜	*4¼	2·71	9	2	..	..	All the cows get half the daily allowance of food at 5-45 A.M., the remainder at 5-15 P.M.,, and milked at 6 A.M. and 5-30 P M.	
1st ,, ...	Do.	160¾	..	1	1½	1½	†3	1·86	17	3	..	..		
1st ,, ...	Do.	..	160¾	15	4⅛	3¾	8¼	5·13	9	2	..	..		
3rd ,, ...	Baggium (Kerry).	55¹¹⁄₁₆	..	26	1	..	‡1	1·79	21	..	..	..		
5th ,, ...	Do.	61⅞	..	25	2¼	¾	3	4·84	8	2	1⅞	62·50	The cows are watered at 7 A M. and 3-30 P.M. daily and grazed between the hours 8 and 10 A.M. and 3-30 and 5 P.M., and are kept in the sheds during the remainder of the day.	
5th ,, ...	Do.	..	37⅛	15	½	‖	½	2·02	26	7	⅜	50·00		
6th ,, ...	Bonu	72¾	..	25	3	¼	3¼	4·46	10	3	2	61·53		
9th ,, ...	Lutchme, grey ..	76¼	..	25	3¾	½	4¼	5·55	8	3	2½	58·82		
11th ,, ...	Sultana I ..	47½	..	25	3½	..	3½	7·36	9	..	2¼	64·28		
11th ,, ...	(Aden) ,, ..	..	32⅝	15	1½	½	2	6·13	10	3	1¼	62·50		
13th ,, ...	Do. II ..	57¹⁄₁₆	..	48	4	‖	4	7·00	7	3	2¼	56·25	¶ From 1st to 3rd May fed with Planters' Friend and horse-gram fodder; from 5 to 6 with Planters' Friend fodder, and from 9 to 16 with green paddy fodder.	
13th ,, ...	(Aden) ,, ..	..	54⁵⁄₁₆	38	4	‖	4	7·36	8	..	2	50·00		
16th ,, ...	Do. III ..	67½	..	51	4½	‖	4½	6·29	7	..	2¼	52·94		
16th ,, ...	(Aden) ,, ..	..	54	39	3¼	‖	3¼	6·01	11	..	1¾	46·15		
16th ,, ...	Do. ,, ..	59⁵⁄₁₆	..	26	2⅜	..	2⅜	4·21	5	..	1¼	50·00		
16th ,, ...	Do. ,, ..	..	54	15	3	..	3	5·55	12	..	1½	50·00		

* Milk was heated after being drawn.
† Fresh milk.
‡ Butter did not form properly.
‖ None All the butter had been obtained.

116. *Sheep.*—The sheep were free from disease during the year. Their daily allowance of food per head, was 10 oz. of ground-nut oil-cake, half of which they get in the morning, and the remainder in the evening. They were grazed usually, in the morning from 8 to 10-30 and in the afternoon from 2-30 to 5-30. At other times, they were kept in the pens, either in the field, or at the farm buildings.

117. The two Southdown Mysore rams, referred to in paragraph No. 65 of last year's report, continued in perfect health; the breeding ewes were all served by them; the new blood, produced considerable improvement in the shape, and in the wool, of the lambs.

118. During the year, 11 rams were sent to the district, for breeding experiments, as shown below :—

Date.	To whom sent.	Number of Rams.
1881.		
17th September ..	The Tahsildar of Tiruvallúr	2
21st October ..	Do. do.	2
22nd do. ..	The Sub-Collector, Chingleput ..	3
28th December ..	The Tahsildar of Tiruvallúr	2
29th do. ..	Do. do.	2
		11

119. In the next table, the strength of the flock, and the number of deaths, are shown. Similar data are also given for the last eight years. The death-rate is low, and this would have been even less, if it had not been necessary to keep in the flock for breeding, many sheep that had passed their prime, the flock being now so small :—

——	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.	1879 80.	1880-81.	1881-82.
Average number of flock	207	221	237	275	295	274	251	160	92
Number of deaths	16	24	21	11	31	34	55	136	4
Percentage of deaths	7·73	10·9	8·9	4	10·5	13·14	*21·9	*85	4
Rainfall in inches	48·07	68·98	38·14	20·88	65·55	33·16	56·95	57·16	44·28

* Outbreak of small-pox, from Commissariat Slaughter-house sheep.

120. The usual statements of stock maintained, percentage of deaths, and the purchased food consumed by the stock, are given in the following table :—

——	1876-77.	1877-78.	1878-79.	1879-80.	1880-81.	1881-82.
Live stock maintained calculated as country cattle	132	135	123	125	102	76
Stock as country cattle per 100 acres of cultivable land	82·5	84·375	84·24	88	83·65	50·60
Percentage of deaths	7·6	12·9	8·9	8·8	16·2	4
Cost of purchased food a head per mensem ..	A. P. 8 6	A. P. 10 6	A. P. 14 5	A. P. 12 1	A. P. 12 6	A. P. 8 9

IMPLEMENTS AND MACHINES.

121. *Implements and Machines.*—More applications for improved implements were received during the past year, than in any previous year, since the farm was established. The statement on the next page shows the implements supplied, during the year, and where they were sent :—

Presidency, Province or District.	Swedish Ploughs.	Large American Ploughs.	Improved Country Ploughs.	Grubbers, Bullock, Hoe, &c.
Godávari	1	..	..	..
Madras	..	14	3	..
Chingleput	1	1	..	..
Madura	..	..	..	2
Tanjore	..	..	61	..
Tinnevelly	..	2	2	..
Mysore	1	1	2	..
Salem	..	..	..	1
Bellary	10	2	..	..
Kurnool	..	..	..	1
Cuddapah	..	..	..	2
Bombay	1	2	..	4
Total ..	14	22	68	10

122. At the close of the year, the registered applications, still to be met, were for 35 ploughs of different sorts. In several instances, the ploughs supplied were obtained merely as patterns, from which to make up others; the number issued therefore, represents but a portion of those introduced through the agency of the farm. As is noticed, in the general report of the year, 300 iron ploughs were ordered direct from Sweden by a firm in Bellary, who, were induced to do so, by the successful working of several Swedish ploughs supplied from the farm.

123. The Board of Revenue on my recommendation, sanctioned the delivery free of charge, of all improved implements required by *bona fide* cultivators. The cost in the year was but trifling, only Rs. 13-2-0, but it amounted to 17 per cent. on the price of the implements. The concession, however, was not, it is believed, very widely known. The next statement, shows the number of implements, on which the farm paid the delivery charges :—

Implement.	Where delivered.	Price paid.	Expenses incurred of delivery.
		Rs. A. P.	Rs. A. P.
59 Improved country ploughs	Tanjore	5 0 0	6 8 0
2 Combined ploughs	Tinnevelly	15 0 0	1 12 0
2 Improved country ploughs with iron stilt	Do.	6 12 0	
1 Swedish plough	Alúr (Bellary District) ..	20 0 0	1 0 0
1 Model of double mhote	Kondápuram (Cuddapah District)	3 8 0	0 12 0
1 Do. do.	Cuddapah	3 8 0	0 12 0
1 Do. do.	Kurnool	3 8 0	0 14 0
1 Swedish plough	Godávari	20 0 0	1 8 0
	Total ..	77 4 0	13 2 0

124. The ploughs in greatest request, for use as patterns, were the single-stilted Swedish plough and the American combined plough. The first mentioned, were supplied at Rs. 20, and the latter at Rs. 13, and, 9 each, according to size. Under an arrangement made with an extensive manufacturer in Sweden, the Department will be able to supply single-stilted Swedish ploughs, made entirely of steel, at Rs. 16 each. Steel possesses many advantages over both cast-iron and wrought-iron, as a material for making ploughs, chiefly, in its greater strength and lightness, while steel can be welded with almost as great ease as wrought-iron.

125. These Swedish steel ploughs are, it is believed, the best ploughs for the requirements of Indian agriculture, that have yet been introduced.

126. A number of improved country ploughs were made up at the request of a land-owner resident in Tanjore, who for the past three or four years has had a Graduate of the School of Agriculture as his Manager. He forwarded a pattern plough which he called the "Nawab" that he said, he had obtained from Cawnpore, and of which, he had been making up copies in Tanjore; but, finding the expense too great, he had given up

further efforts in that direction. On receipt of the pattern at Saidápet, it was examined and tried, and was found defective in several respects. Another improved form of a country plough was, therefore, made up and sent to the land-owner, for experimental trial, along with his pattern plough. He wrote: "I have received the ploughs sent to me by Mr. Schiffmayer, and experimented with them in the wet lands, and find that the cattle here works with your light improved pattern with greater amount of ease and facility than the "Nawab" plough, and at the same time, this improved pattern inverts the furrow sods at the proper degree or position, whereas the other plough fails to do so. * * * * I therefore request that you would be pleased to order for the construction of 80 ploughs of your improved pattern, in the Farm Workshops." In explanation of a Madras Land-owner sending all the way to Cawnpore for ploughs it should be stated that, he first applied to the farm for ploughs, but that, the workshops then being closed, through some misapprehension on the part of Government, no ploughs could be supplied from the farm, and he had, therefore, no choice but to send to Cawnpore. This improved country plough, weighs about 30 lb.; though a low-priced plough, it is not one that can be recommended for general use; it cannot, in full work, last longer than a ploughing season, without repair, and it is always liable to break, when the work it is required to do, is at all rough in character. It is adapted only for use on wet land, or, very light dry land, but is not suited for deep ploughing. Another improved country plough, made entirely of iron, except the pole, has proved fairly successful for irrigated land, and for working between the rows of cotton and similar work. The stilt of this plough is fitted with a cross bar, to admit of both of the ploughman's hands being used. These ploughs cost from Rs. 6 to 7, each. They are much stronger, and, therefore, more useful, than those with wooden stilts.

127. Great difficulty has been met, in experimenting on the farm with single-handle ploughs, made like the country plough. The farm ploughmen have, for years used only the double-handle ploughs of the European pattern, which require far less exertion on the part of the ploughman, than country ploughs. The men most decidedly prefer the double-handle ploughs. A great deal of nonsense has been written regarding the supposed advantage of a single-handle plough, in its admitting, when at work, of the ploughman using one of his hands in twisting the tails of his cattle. The farm ploughmen, plough a much larger area of land in a day than is usually ploughed elsewhere, yet, as has already been noticed, they work only double-handle ploughs, and never touch the tails of their cattle; indeed, any such reprehensible performance in tail-twisting, though apparently, in some quarters, deemed inseparable from ploughing with cattle, would lead to the immediate dismissal of the ploughman. Each ploughman, uses a pair of reins, and carries on his plough a light whip, which he occasionally uses. Each man manages entirely his own plough and cattle; some of the men, can make as straight a furrow as, is made in other countries.

128. A new implement was constructed which, promises to be useful. It is a copy of one used largely in Germany. It consists of a strong iron beam which, has holes for the reception of coulters fitted with shares; these are broad and narrow for broad sharing, grubbing, or sub-soiling; and one of the coulters is fitted with a mould-bard, so that, the implement may be used as a cultivator, a grubber, a sub-soiler, and as a plough. Attention is being given to this implement, in view to its further improvement, and adaptation to the wants of this country.

129. Models of the double mhote, are still in request. They are supplied and delivered, free of charge, to applicants.

MISCELLANEOUS.

130. *Estate.*—The expenditure incurred on behalf of the estate, was chiefly for maintaining the buildings, roads, bridges, water channels, &c., in good repair. A small office was built for the use of the Overseer and Storekeeper.

131. *Farm Accounts.*—The usual abstract statements, appear in the appendix.

132. *Commissariat Slaughter-houses.*—The slaughtering of cattle at Commissariat premises on the Farm will, it is hoped, shortly cease, and thus, a nuisance, which

has been experienced for years, will be removed. On the transfer of the buildings to the charge of this Department, it is intended to extend considerably operations in dairying, as this branch of farming, has received so little attention, and it is one of considerable importance, seeing that such a large a percentage of the population, are milk consumers.

133. *Criminal Reformatory.*—The proposal, made some years ago, to start a Criminal Reformatory on a portion of the Farm estate, having again been revived, it has been necessary to state most decidedly that, to attempt to carry out the proposal would be highly prejudical, both to the work of the Farm, and that of the Agricultural College. The aim of both these institutions is, to raise the status of agriculture; and to enlist the interests of the well-to-do classes in the cause of agricultural reform; but, to associate either institution, even in the remotest degree, with the criminal classes, would be fatal to success. Indeed, the proposal, is so preposterous, it is scarcely possible to consider it as having been seriously made.

134. *Irrigation experiments.*—Sanction has been obtained for the construction of a new sluice in the tank, which supplies irrigation water to a portion of the farm; when this is completed, it is hoped that, it will be possible to carry out the long-deferred irrigation experiments.

135. *Non-Experimental Area.*—The piece of land set apart under the instructions of the Board of Revenue, as a non-experimental area, was cropped, during the year, with ordinary crops. The results of the year's work, are shown below :—

Dr. *Cr.*

	RS.	A.	P.		RS.	A.	P.
Value of standing crop, June 1st, 1880	59	0	0	Value of produce received during the year	767	3	9
Value of unexhausted manures, June 1st, 1880	72	0	0	Value of crop standing, May 31st, 1881	75	0	0
Cattle labor supplied	472	1	2	Value of unexhausted manure, May 31st, 1881	96	0	0
Cooly do. do.							
Manure do.	120	0	0	Cultivation carried forward, May 31st, 1881	15	0	0
Seed, &c., do.	104	5	6				
	827	6	8		953	3	9

These figures are, however, but compilations from the general accounts of the Farm, it having been found impossible, without incurring unnecessary expense, to stock the land, and provide it with its own implements, and working agency. The land is, however, most disadvantageously situated, and proposals have been made to set aside another portion of the Farm for the purpose, where the drawbacks are less serious. It is, however, more than doubtful, whether it is wise to employ time and means, in carrying out such work, while there remains so much legitimate experimental work very urgently demanding attention, and for which, in the whole of the Presidency of Madras, with a revenue of four million pounds sterling, depending on agriculture, there is no other agency for doing. In every civilized country, those whose duty it is to direct State efforts towards the improvement of agriculture hold that, it is pre-eminently the duty of State Agricultural Institutions, to engage in work of research and inquiry, leaving to those actually engaged in farming, the application of the facts ascertained,

136. *Pisciculture.*—Nothing has yet been done at the Farm, in the artificial breeding of fish but, for 13 years or more the portion of the River Adyar, which forms the southern and eastern boundaries of the Farm estate, has been strictly preserved, only rod fishing having been allowed. Usually, once or twice a year, a portion of the river has been dragged, in view to the capture and destruction of the predacious fish. The results, of preserving, having been very encouraging, as regards the increase in the number of fish. It is now proposed, to introduce into the river some better kinds of fish. The predacious fish, which are numerous, will always be a hinderance in the way of getting up a stock of useful fish; but, it is quite impossibe to capture and kill the whole, for considerable portions of the river cannot be netted from its depth, and the inequalities in the rocky bed; and whenever the river is in flood, fresh stocks of predacious fish come down from tanks, and the higher portions of the river. But after

all, it does not seem so necessary to strive to kill the last of the predacious fish, were there any possibility of any such result being achieved, for the nonpredacious ones are, already, able to take care of themselves, and, are more numerous than their predacious neighbours.

137. *Snakes, &c.*—The persistent efforts to kill down snakes, on the Farm estate, have been attended with gratifying results. Snakes are now seldom met with on the Farm, whereas 10 or 12 years ago, they were very numerous indeed. This, must be attributed partly to the clearing of a considerable area of land, but, is chiefly the result of the small rewards given for the destruction of snakes. These rewards were for a cobra two annas, and for any other snake one anna; the cost, has not amounted to more than about one anna, per acre, per annum. It is true, that many non-poisonous snakes have been killed, but it is better that this should happen than, to risk the chance of any poisonous snake escaping. It was said that, when the war against snakes was begun on the Farm, that rats, of which snakes are the foes, would multiply to such an extent as to prove a more serious evil than the snakes, but, such has not been the experience on the Farm. Indeed, rats appear to be far less numerous, than they were, when snakes were abundant. The killing down of the snakes, has resulted in a very large increase of birds, some varieties of which, especially those of the owl family, may have contributed towards keeping down the rats. Birds were never so numerous on the Farm estate for a long time, as they have been in the past few years, a result, which must be attributed entirely to the diminished numbers of their natural enemies—the snakes. Some alarm, appears to have been created, in certain quarters, regarding the supposed diminution in the number of birds beneficial to agriculture; but, this alarm appears to be quite groundless. The simplest way, to keep up a good supply of insectiverous birds is to encourage the destruction of snakes.

138. *Personnel.*—Mr. Schiffmayer was absent on sick leave, from the beginning of the year, until the 2nd of November. The Farm, was in Mr. Benson's charge up until the 4th of August, when he also, was obliged to take sick leave, and he continued absent up to the close of the year. On the 2nd of November, Mr. Schiffmayer returned to duty, and took charge of the Farm, which charge, he retained until the close of the year. The members of the subordinate establishment, have afforded satisfaction, in the performance of their respective duties.

SAIDAPET,
19th June 1882.

(Signed) W. R. ROBERTSON, M.R.A.C.,
Superintendent, Government Farms,
Madras Presidency.

APPENDICES.

APPENDIX I.

STATEMENT showing the Monthly Rainfall, compared with the Average of the previous Twelve Years.

Month.	1881-82.		Average of 12 Years.	
	Rainfall.	Wet Days.	Rainfall.	Wet Days.
April	..	..	·35	·5
May	·14	1	3·78	1·9
June	1·00	6	2·52	5·9
July	3·19	5	3·72	8·9
August	5·29	9	4·83	9·6
September	7·95	12	6·08	8·4
October	2·85	4	11·17	11·7
November	16·86	16	13·28	12·8
December	6·43	7	4·03	5·8
January	·57	3	·81	1·2
February	..	..	·95	·6
March	.	..	·29	·5
Total ..	44·28	63	51·81	67·8

STATEMENT showing the Weekly Rainfall during 1881-82, with the Average of the previous Twelve Years.

Weeks.	1881-82.		Average of the previous 11 Years.		Weeks.	1881-82.		Average of the previous 12 Years.	
	Rainfall.	Wet Days.	Rainfall.	Wet Days.		Rainfall.	Wet Days.	Rainfall.	Wet Days.
1st Week	..	..	·18	·16	27th Week	2·81	4	2·07	2·66
2nd ,, ...	..	..	·00	·08	28th ,, ...	..	..	1·41	1·83
3rd ,, ...	..	..	·04	·17	29th ,, ...	..	..	3·05	2·99
4th ,, ...	..	..	·00	·08	30th ,, ...	·05	1	3·45	3·24
5th ,, ...	..	..	1·28	·49	31st ,, ...	·65	3	1·94	2·33
6th ,, ...	..	..	·09	·25	32nd ,, ...	3·56	6	2·63	2·41
7th ,, ...	..	..	·14	·50	33rd ,, ...	8·95	5	3·85	4·16
8th ,, ...	·14	1	1·08	·50	34th ,, ...	3·65	2	2·88	3·25
9th ,, ...	·10	1	·11	·25	35th ,, ...	·05	1	3·45	2·58
10th ,, ...	·36	2	·55	·39	36th ,, ...	..	..	1·97	1·83
11th ,, ...	·05	1	1·00	1·41	37th ,, ...	1·73	3	·39	1·49
12th ,, ...	·47	1	·33	1·25	38th ,, ...	·95	1	·55	1·25
13th ,, ...	·02	1	·42	1·83	39th ,, ...	·80	1	·44	·91
14th ,, ...	..	..	·70	1·41	40th ,, ...	3·52	5	·02	·24
15th ,, ...	·29	3	·81	1·74	41st ,, ...	..	..	06	·08
16th ,, ...	..	..	·90	2·24	42nd ,, ...	..	..	·43	·68
17th ,, ...	·75	1	·69	2·16	43rd ,, ...	..	..	·14	·41
18th ,, ...	2·15	1	1·26	2·33	44th ,, ...	..	..	..	..
19th ,, ...	3·51	4	1·14	2·41	45th ,, ...	..	..	·56	·41
20th ,, ...	·30	1	1·34	2·25	46th ,, ...	..	..	..	..
21st ,, ...	1·10	3	·72	1·83	47th ,, ...	..	..	·30	·16
22nd ,, ...	·58	2	1·16	2·08	48th ,, ...	..	..	·04	·08
23rd ,, ...	1·36	1	1·94	2·57	49th ,, ...	..	..	·13	·33
24th ,, ...	·98	4	1·55	2·16	50th ,, ...	..	..	..	..
25th ,, ...	4·50	4	1·32	1·41	51st ,, ...	..	..	·25	·16
26th ,, ...	·90	1	·95	1·03	52nd ,, ...	..	..	·05	·08

APPENDIX II.

STATEMENT showing the number of Stock maintained during each month of the Year 1881-82.

—	1881.									1882.			Average.
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	
Cattle	28	27	30	30	29	29	38	39	39	44	44	44	35
Sheep	103	96	92	91	91	86	82	78	74	111	111	107	94
Equivalent as country cattle of 300 lb. live weight.	70·8	67·6	69·8	69·6	67·5	66·7	77·7	77·6	76·8	86·0	88·9	88·1	75·6

Cost of purchased, and Farm-grown, Food, supplied to the Live Stock, during the Year 1881-82

—	Working Cattle.		Cows and Calves.		Sheep.		Amount supplied.	Value.
	Amount.	Value.	Amount.	Value.	Amount.	Value.		
	LB.	RS. A. P.	LB.	RS. A. P.	LB.	RS. A. P.	LB.	RS. A. P.
Ground-nut Oil-cake ..	34,668	404 7 4	8,954	104 7 5	13,581	158 7 1	57,203	667 5 10
Bran	..	..	6,207	124 2 3	299	5 15 9	6,506	130 2 0
Salt	464	15 3 4	81	2 10 6	146	4 12 6	691	22 10 4
Grains	142	2 13 5	2,524	57 13 6	259	5 7 5	2,925	66 2 4
Dholl husk	..	..	584	11 10 11	..	..	584	11 10 11
Total ..	..	422 8 1	..	300 12 7	..	174 10 9	..	897 15 5
Deduct ⅓ Charged to Manure	..	140 13 4	..	75 3 2	..	58 3 7	..	274 4 1
Net Charge ..	..	281 10 9	..	225 9 5	..	116 7 2	..	623 11 4
Cost per head per mensem.	..	1 1 2	..	2 5 5	..	0 1 10	..	1 6 0

APPENDIX III.

Statement of the Accounts of the Saidápet Farm, for the Year 1881-82.

BALANCE SHEET, 31ST MARCH 1882.

Liabilities.	RS.	A.	P.	*Assets.*	RS.	A.	P.
Capital	24,949	14	5	Valuation on 31st March 1882.	25,077	0	0
Due to sundry persons ..	420	2	0	Due by sundry persons ..	293	0	5
Total ..	25,370	0	5	Total ..	25,370	0	5

CASH ACCOUNT FOR 1881-82.

Receipts.	RS.	A.	P.	*Expenditure.*	RS.	A.	P.
Capital advanced by Government	6,002	5	8	Live Stock	2,186	7	11
Live Stock	574	9	11	Seeds	477	12	10
Implements and Machines ..	1,187	12	0	Implements and Machines ..	1,758	12	11
Sundries	541	0	11	Sundries	333	1	8
Crops	1,887	4	11	Labor	3,001	0	0
				Establishment	1,581	0	0
				Despatching Seeds	448	11	5
				Manures	406	2	8
Total ..	10,193	1	5	Total ..	10,193	1	5

PROFIT AND LOSS ACCOUNT.

	RS.	A.	P.		RS.	A.	P.
Establishment	1,581	0	0	Sundries	228	11	3
Bad Debt	10	6	0	Capital for balance	5,388	9	8
Despatching Seeds ..	448	11	5				
Implements and Machines ..	1,191	1	11				
Live Stock	1,007	8	7				
Labor	513	7	0				
Crops	865	2	0				
Total ..	5,617	4	11	Total ..	5,617	4	11

Valuation of the Saidápet Farm and Estate made on the 31st March 1882, compared with that made on the 31st March 1881.

—	Valuation of Stock on the 31st March 1881.			Increase in the Year.			Decrease in the Year.			Valuation of Stock on the 31st March 1882.		
FARM.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Live Stock (*a*)	2,112	0	0	768	8	0	....			2,880	8	0
Crops (*b*)	16,173	0	0	899	0	0	....			17,072	0	0
Manures	244	0	0	....			133	15	0	110	1	0
Implements (*c*)	5,669	0	0	....			654	9	0	5,014	7	0
Total ..	24,198	0	0	879	0	0	....			25,077	0	0
ESTATE.												
Land	35,000	0	0	....			....			35,000	0	0
Buildings (*d*)	24,600	0	0	....			1,800	0	0	22,800	0	0
Wells and Channels	7,000	0	0	....			....			7,000	0	0
Total ..	66,600	0	0	....			1,800	0	0	64,800	0	0

(*a*) Includes live stock and cattle food increase due to cattle purchased.
(*b*) Do. trees, standing crops and grains.
(*c*) Decrease due to sales and worn out implements.
(*d*) Do. due to deterioration of buildings.

RESOLUTION—dated 8th August 1882, No. 1962.

The Board submit to Government their General Report on the Saidápet Experimental Farm for the year 1881-82.

2. The season was not favorable to farm operations. Want of rain prevented the sowing of any hot-weather crops, while heavy rains at the blossoming season seriously injured much of the then young cold-weather crops. The cyclone of November moreover did great damage to topes and standing crops.

3. Neither "smut" nor "ergot" was observed on the crops owing to the seed being dressed with a solution of sulphate of copper before sowing, while fungus and insects which attacked the crops were successfully opposed by improved manipulation of irrigation water.

4. 34·01 acres were sown with *fodder crops*, the outturn of which was, on an average, 3·307 lb. per acre; but one crop of yellow cholum (*Sorghum vulgare*) yielded 19·193 lb. per acre, without irrigation. 36·85 acres were sown with *Unirrigated cereals*, the outturn of which was generally fair. The *maize* crop, on poor soil without the aid of irrigation water, but with good tillage and the moderate use of manure, yielded a nett return, valued, over and above the cultivation expenses, at Rs. 25-3-1 per acre. *Broom millet*, a variety of *Sorghum*, was tried with success yielding an outturn of 960 lb. of grain and 4,256 lb. of straw per acre. This is the first experiment in this country with this grain. But the stalk is void of saccharine matter, and it is not known if the seed panicles are as suitable for broom making in this country as in America. This should be ascertained before distributing seeds. The cultivation of the *Minnesota early amber sugar-cane*, another variety of *Sorghum*, promises to yield good results in the future. Chinese sugar-cane also yielded a large outturn. There seems little use in continuing the cultivation of *Reana luxurians;* the grain is useless, and the fodder is watery and destitute of saccharine matter. 14·28 acres were cultivated with *Irrigated cereals*, resulting in an average outturn of 978 lb. of grain and 4·107 lb. of straw per acre. *Madagascar paddy* was a failure owing to the badness of the season, and an unfortunate mistake about the seed-grain. Some samples of the grain were sent to London for professional valuation, and the results will be found at length in paragraph 32 of the Report. The experiments should be continued, as the circumstances of the year were unusually disadvantageous. 38·69 acres were under *Industrial crops*. *Casuarina trees*, which are gradually being removed, sold at something less than Rs. 2 per tree. The other crops were *castor-oil*, *indigo*, and *cotton*. The former was sown more as a "catch-crop" than a regular farm-crop. The yield of indigo was but small, chiefly owing to the bad season. The cotton outturn was similarly inferior. *Yca valley cotton* promises to become a valuable source of income hereafter, and seed will be sent into the districts when available. Of miscellaneous crops, *Manilla hemp* seems to be of little value owing to the difficulty of extracting the fibre. Possibly the system of agricultural exhibitions may result in the invention of some cheap machine for the purpose which may raise the value of the plant. Mr. Robertson recommends the common plantain as more likely to yield good fibre and is inquiring in America for mills for the purpose. The other small crops of this (miscellaneous) class call for no special remark, with the exception of the pasture grass called *Panicum brownii* on which the Superintendent reports very favorably, styling it "decidedly the best that has yet been introduced into this part of India." The seed was obtained from the United States.

5. The Superintendent has gone at length into the question of *Manures* (paragraphs 80 to 103), but it is obvious that careful experiments for a series of years must be conducted before it will become desirable to draw general conclusions from ascertained results.

6. *Live-stock.*—The Aden breed of cattle continues to prosper, and the Superintendent should carry out the proposals embodied in paragraph 107 of the Report, viz., to station some of the bulls in different parts of the country for breeding purposes.

The Board desire that this be done without delay. The milk produced during the year by the old Aden cow, which cannot now be less than fourteen years old, is very remarkable, being, for the ten months, 965·2 measures, estimated at 3·350 lb., a better proportional return than that of most of the best dairy-breeds.

7. *Machinery, &c.*—The value of improved ploughs is, the Board are glad to notice, becoming more generally recognized throughout the country. The Swedish plough appears to be the best, and is relatively the cheapest.

8. The Board must again call attention to the fact that no attempt has yet been made, in spite of repeated references, to commence operations on a selected area set apart for a Commercial or Model Farm. This has been insisted on more than once as the crucial test by which the value of all the agricultural operations hitherto carried out must be measured, and the Board look to the Superintendent to conform to their wishes without further delay. Mr. Robertson seems disinclined to make this trial until he can be certain of turning out good results, but the Board remark that by so doing he entirely misses the whole point of the experiment, which is to prove practically to the farmers of the country the benefits to be derived from improved farm-operations, not only in good, but in bad seasons, and not only on the finest classes of land, but on inferior or poor soil. All experimental cultivation is practically worthless unless the results can be actually proved to tend to financial success.

9. It is observed that the Report does not deal with the financial results of the various operations of the Farm in sufficient detail.

(True Copies and Extract.)

(Signed) R. SEWELL,
Acting Sub-Secretary.

To the Secretary to Government, Revenue Department.
" Superintendent of Government Farms.
To all Collectors.

ORDER—dated 7th September 1882, No. 958, Revenue.

Miscellaneous.

The Government resolve to pass orders on this report separately, in order that the interesting information it contains may be available as early as possible for intending exhibitors and competitors at the Agricultural Exhibition which it is proposed to hold in Madras in February next.

2. The year on the whole was unfavorable. The several experiments commented on in paragraph 4 of the Board's Proceedings were, however, conducted. Mr. Robertson could probably arrange with M. R. Ry. Krishnasawmi Moodelliar Avargal for a trial of maize on his estates in Tanjore, where the difficulty experienced at Saidápet, viz., the sandy soil, would not be experienced. The Government will be interested in the results of the contemplated District experiments with Broom Millet. The experiments with Minnesota Early Amber Cane are satisfactory and encouraging. *Reana luxurians* has already been condemned—G.O., 4th November 1881, No. 1641. Madagascar paddy should receive a further trial as proposed.

3. With reference to paragraph 46 of his report, Mr. Robertson is aware that *Musa textilis* has been cultivated with success in the Wynaad.

4. The experiments with manures have been described at considerable length. The results are interesting; but the Government concur with the Board in deprecating general conclusions at this stage. Extended observations should be made. The account of the live-stock is satisfactory.

5. The remarks made by the Board in paragraph 8 of their Proceedings are entirely approved by Government, who desire that a model, as distinguished from an experimental institution, should be forthwith established. It is in the Mofussil, however, that it is most important to demonstrate that improved farming in accordance with western ideas will pay. Mr. Robertson, with his experience of South Indian Agriculture, should be able to afford this proof, and the exhibition of a satisfactory balance sheet after the lapse of a year or two would do far more to promote an improved system of agriculture than the prosecution of costly experiments from public funds.

(True Extract.)

(Signed) E. F. WEBSTER,
Secretary to Government.

To the Board of Revenue.

Exd. W. H. French.

80 Copies.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ—the following Proceedings of the Board of Revenue, dated 5th December 1881, No. 3059:—

Read the following Report from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to the Secretary to the Board of Revenue, dated Saidápet, 30th July 1881:—

THE operations conducted on the Saidápet Farm having been so fully noticed in a separate report, it is necessary only to refer briefly to this institution.

Season.

2. The weather during the cropping season was, on the whole, favorable. The rainfall of the year was slightly higher than the average fall of the previous ten years, while it was distributed over a longer period than usual. Crops were free from attacks by fungoid diseases and of injurious insects, except late in the season when the cotton crop suffered from "rust," and, the paddy crop in low-lying, badly-drained situations, from attacks by insects.

3. In addition to the ordinary indigenous and introduced crops, Planter's Friend (*Sorghum Kaffrarium*), Chinese sugarcane (*Sorghum saccharatum*) and Madagascar paddy were grown.

Cereal fodder-crops did not yield well.

4. The ordinary cereal fodder-crops did not yield so well as usual, but the leguminous ones yielded very satisfactorily.

5. The summer rains having been deficient in the early part of the season, no summer grain crops were grown.

6. Of cereal irrigated crops, the first crop was good, but the second crop, chiefly car paddy, was not all brought to maturity under satisfactory conditions, much of the crop being only half-grown when the tank-water became exhausted. However,

Outturn of paddy crop.

over the whole area of irrigable land, in a period of 7 months, the yield obtained was 26,517 lb. of grain and 67,067 lb. of straw, or an average outturn per acre of 1,594 lb. of grain and 4,033 lbs. of straw.

Cotton crops.

7. The outturn of the cotton crop varied greatly; the greatest produce was gathered in March, April and May. As in former years, the highest percentages of lint were obtained in the produce gathered before the end of June, after which period there was a steady fall in the yield of lint. The yield per acre varied from 363 lb. down to 159 lb. of seed-cotton, but this was in addition to a cereal crop produced on the same land

in lines between the rows of cotton plants. Some modifications were introduced in the method of cropping land with cotton and a cereal crop, which are likely to lead to good results, chiefly by enabling the land under cotton to be kept more thoroughly tilled.

New sugar mill.

8. The produce of a small plot of sugarcane was crushed by means of the Beehea Sugar Mill newly introduced at Saidápet. The results of its working were very satisfactory. There can be no doubt but that, when the merits of this mill are better known in South India, there will be a large demand for it. Some useful experiments were made in the preparation of jaggery from sugarcane, and in determining the crystallizable sugar in the juices of Sorghum and Planter's Friend.

Large yield of Arrowroot.

9. Arrowroot was found to grow very readily on the farm; one plot yielded per acre nearly 4,000 lb. of tubers, and another 7,500 lb. A large quantity of arrowroot flour was made; it was found that, on the average, 100 lb. of tubers yielded 12½ lb. of flour. Thus a yield of 7,500 lb. of tubers per acre would represent an outturn of 1,875 lb. of flour, which at only 4 annas a pound would represent upwards of 400 rupees per acre. Seeing how easily the crop is grown and how simply the flour is prepared, it is a matter of surprise that the crop is not more generally cultivated.

Manilla hemp plants thrive.

10. The Manilla hemp plants (*Musa textilis*) are thriving satisfactorily; a number of young shoots have been planted out.

11. Several samples of the farm-grown tobaccos, differently treated in the field and in the processes of curing, have been analysed. Though the analyses show a very marked improvement over those of the tobaccos produced in previous years, the tobaccos nevertheless are, from their poverty in salts of potash, quite unfitted for the European market. It is worthy of note, however, that the tobaccos recently produced contained *eight times* as much carbonate of potash as the tobaccos produced on the farm and analysed in 1872.

Great improvement in tobacco raised on the farm.

12. Several experiments were made with manures of different kinds on a set of experimental plots specially set apart for this purpose; the experiments are to be conducted over a series of years. And, a set of experiments were instituted to determine the comparative manurial value of cattle-dung and cattle-dung ashes, which experiments will also require several years to complete.

Manure experiments.

13. The Aden stock continues to merit the high opinion expressed of the breed in former reports. Arrangements have been made to procure some fresh stock from Aden. Some experiments were made with Punganur cows, an indigenous breed having a local reputation; but the results of the experiments proved that the cows are far inferior milkers to those of the Aden breed.

Cattle-breeding experiments.

14. The sheep breeding experiment continues to make satisfactory progress. In view to hasten the work of improvement, some half-bred Southdowns rams have been procured. A number of rams of the Saidápet breed were distributed to flock owners in the Chingleput, Bellary, and Tinnevelly Districts.

Sheep-breeding experiment.

15. The Implement Workshops having been closed until late in the year, but little was done in the manufacture of implements and machines.

THE GOVERNMENT SCHOOL OF AGRICULTURE.

16. As usual a separate report will be prepared, showing, in full detail, the work of this institution. The following brief remarks must therefore suffice.

There were in the year 34 students under training. Of these, 7 were paid stipends, provided as below :—

Travancore State	2
Holkar State	1
Wadhwan State	1
Nariad Agricultural Association	3

and 12 were supported by their friends; the other students held Government stipendiaryships.

Agricultural lectures in the Government Normal School.

17. It was found impossible to arrange for the delivery of a course of Agricultural lectures at the Government Normal School, and, unfortunately, arrangements could not conveniently be made by the school authorities to enable the students of that institution to attend the Agricultural lectures in the School of Agriculture. This is much to be regretted, for even though the knowledge gained by attendance at a short course of Agricultural lectures cannot but be slight, it must be of some service to men who, in after life, will be employed in teaching in country schools, attended chiefly by youths of the agricultural classes, and especially now that an Agricultural textbook is in use in most of these schools.

Lectures.

18. The usual courses of lectures were delivered on the following subjects: Agriculture, Veterinary Surgery, Chemistry, Botany, Mechanics, Meteorology, Physical Geography, Arithmetic, Bookkeeping, Mensuration, &c.; while numerous out-of-door classes were held for practical instruction in Agriculture, Botany, Surveying, &c., and in the Chemical Laboratory frequent classes were held of the more advanced students for practice in chemical manipulation, the physical analysis of soils, the qualitative examination of substances, &c. The ordinary Gymnastic classes were maintained. The results of this training were very marked, and must have contributed largely to the good health which the students generally enjoyed. At the ploughing examinations which every student must pass, some very creditable work was done.

Some good ploughmen.

Buildings for the College.

19. Considerable progress has recently been made in providing the permanent buildings for the College. The Veterinary Hospital buildings have been completed, but the institution cannot be opened until the quarters for the Hospital Keeper are available.

20. The Botanical grounds have been maintained in good order, and further efforts made to collect those specimens of the various trees, shrubs and plants with which it is desirable the students should become acquainted. These grounds are useful also for making experiments on a small scale with different agricultural plants, while the gardens supply fresh specimens for illustrating the Botanical lectures.

21. A number of books were added to the Library, and the Reading-room was supplied with various agricultural periodicals. Both the Library and Reading-room have been made good use of by the students.

22. The system of paying the Lecturers by fees still continues in operation. The arrangement is a convenient one, but not so economical or efficient as is desirable.

AGRICULTURAL TOURS.

23. The only tour made by an officer of this department was one made in Bellary by Mr. Benson during the month of August last. His report on this tour has been submitted.

AGRICULTURAL EXHIBITIONS.

24. None were held during the year, it having been thought that the country had not sufficiently recovered from the effects of the recent famine to render it advisable to hold any agricultural exhibitions. Proposals, however, are under consideration for organising a scheme of agricultural shows, to be held in various parts of the Presidency.

SEED DISTRIBUTION AND DISTRICT EXPERIMENTS.

25. The undermentioned seeds were distributed, and in most instances delivered free of charge, for experimental cultivation :—

	LB.
Reana luxurians	34
Planter's Friend (*Sorghum Kaffrarium*)	126
Chinese Sugarcane (*Sorghum saccharatum*)	161
Yellow Cholum (*Sorghum vulgare*)	37
Maize (*Zea mays*)	
Madagascar Paddy	40
Carolina Paddy	
New Orleans Cotton-seed	87
Tobacco-seeds	4
Indigo-seed	68
Oil-seed	
Miscellaneous seeds	

Seed distribution on larger scale necessary.

It is to be regretted that the distribution was on such a very small scale. This part of our work, the usefulness of which is obvious, needs much greater attention than at present it receives. Government have occasionally in previous years distributed seed on a large scale, not always with the best results, but generally with as good result as could be expected. In the absence of any private enterprise in the production or importation of good seed, this matter must receive attention by the State. In some portions of the Presidency very good seed is obtainable, while in other portions the seed only procurable is of a very poor description. This department might act, to some extent, as an agency for bringing the good seed to localities where it is needed. This subject, however, will be dealt with separately.

26. *Sorghum Saccharatum.*—Information regarding the results of the experiments made with this crop has been received from three districts—Tinnevelly, Coimbatore and North Arcot. From the first mentioned district it was reported that the experiments had been on the whole satisfactory, and that the ryots apparently appreciate the crop, because it was found to yield a larger quantity of fodder and of a more excellent quality than indigenous cholum. From Coimbatore the reports were less satisfactory, as regards the yield obtained from many of the experimental plots. One very successful experiment was conducted in that district by the Vice-President of the Coimbatore Municipality, in which he obtained 1,700 lb. of grain and 9,000 lb. of straw per acre, an outturn which would have been even larger had the crop not been sown at an unfavorable season of the year. Regarding his experience in feeding stock with this fodder, he reported that he had no doubt whatever as to the great superiority of Sorghum over indigenous cholum as fodder for cattle ; the former he said they ate up with avidity, while of the latter some portions were rejected. Another very successful experiment was made in the Coimbatore Division, in which an outturn of grain amounting to 2,583 lb. per acre was obtained. In the North Arcot District the results were but poor, and the grain was said not to be appreciated as a food-grain, because of the bitter taste it was said to possess. In none of these districts does there appear to have been any attempt to extract the saccharine juices of the plant to which the value of the crop is chiefly due. The general results were as recorded on the next page :—

Sorghum Saccharatum.

No.	General Nature of Soil.	Area of Land sown.	Kind and Quantity of Manure used.	Pounds of Seed sown.	Date of Sowing.	Cultivation during growth of Crop.	Number of times irrigated.	Number of Inches of Rainfall and Number of Wet Days recorded at nearest Station during growth of Crops.		Date when Crop harvested.	Duration of Growth.	Outturn per Acre.		
								Wet Days.	Inches.			Green Fodder.	Grain.	Dry Straw.
						Tinnevelly District.								
		ACRE.									DAYS.	LB.	LB.	
1	Sandy red soil ...	·08	10 cart-loads of ashes, dung, &c.	17½	1st Nov. 1879.	Once weeded by hand.	Not irrigated ...	5	...	10th Jan. 1880.	70	6,000	...	...
2	Black soil ...	·15	Sheep dung, sheep penned (1,000 sheep) one night.	17½	10th do. ...	Do. ...	Once watered by baling.	7	...	25th do. ...	76	5,200	...	...
3	Red soil ...	·12	10 cart-loads of dry dung and ashes.	15	10th do. ...	Do. ...	Not irrigated ...	7	...	31st do. ...	82	2,500	...	...
4	Do. ...	·13	Do. ...	15	10th do. ...	Do. ...	Do. ...	7	...	31st do. ...	82	2,677	...	...
						Coimbatore District.								
1	Black loam ...	·50	5,000 lb. of poor manure formed of street rubbish or sweepings.	12	1st Mar. 1880.	...	7 times ...	27	5·13	8th June 1880.	99	...	1,716	9,000 lb.
2	Red soil	·25	Sheep dung (sheep were penned for 3 months).	2	20th Nov. 1879.	Once weeded ...	10 do. ...	5	·49	25th Feb. 1880.	97	...	720	60 Loads.
3	Red loam ...	·25	Cow and sheep dung, 40 maunds.	3½	10th do. ...	None	5 do. ...	6	1·19	28th do. ...	110	...	180	1,000 lb.
4	Red soil ...	·30	Sheep dung (sheep penned for 30 days).	5	17th Mar. 1880.	Once weeded ...	2 do. ...	10	2·00	2nd July 1880.	107	...	145	771
5	Black soil ...	·24	2 cart-loads of cow-dung and 2 cart-loads of ash.	5	18th do. ...	Do. ...	4 do. ...	10	2·00	6th do. ...	110	...	375	1,458
6	Red soil ...	·50	40 bandy-loads of cattle dung and ashes of town sweepings.	5	5th do. ...	Do. ...	7 do. ...	20	4·00	13th June 1880.	100	...	1,680	3,525
7	Black soil ...	1·00	24 do. do. ...	10	10th do. ...	Do. ...	4 do. ...	20	4·00	12th do. ...	94	...	814	2,125
8	Mixed soil ...	·50	2 do. do. ...	5	14th do. ...	Do. ...	4 do. ...	20	4·00	16th do. ...	94	...	1,037	3,425
9	Black soil ...	·25	2 do. do. ...	2½	20th do. ...	Do. ...	5 do. ...	20	4·00	24th do. ...	96	...	230	1,650
10	Do. ...	1·00	12 do. do. ...	10	5th do. ...	Do. ...	3 do. ...	20	4·00	21st do. ...	108	...	2,584	5,000
11	Do. ...	·50	4 do. do. ...	5	10th do. ...	Do. ...	6 do. ...	20	4·00	15th do. ...	97	...	648	2,675

27. *Planter's Friend.*—This crop was experimented with in Tinnevelly and the Coimbatore Districts. The opinions expressed of it differed but little from those expressed regarding the previous mentioned crop. The crop appears to have been grown chiefly as a grain crop. It is, however, to be recommended more as a sugar and fodder producer. No trials appear to have been made to determine the amount of saccharine juices present in the plant. The general results of the experiments are as follow :—

Planter's Friend.

No.	General Nature of Soil.	Area of Land sown.	Kind and Quantity of Manure used.	Pounds of Seed sown.	Date of Sowing.	Cultivation during growth of Crop.	Number of times irrigated.	Number of Inches of Rainfall and Number of Wet Days recorded at nearest Station during growth of Crop.		Date when Crop harvested.	Duration of Growth	Outturn per Acre.		
								Wet Days.	Inches.			Green Fodder.	Grain.	Dry Straw.
			Tinnevelly District.											
1	Black soil ...	ACRE. ·07	Sheep dung, sheep penned (100 sheep) one night.	17½	1st Sept. 1879.	Once weeded by hand.	Thrice watered by baling from well.	9	...	10th Dec. 1879.	DAYS. 100	LB. ...	LB. 714	LB. 17,714
2	Do. ...	·15	Do. ...	17½	10th Nov. 1879.	Do. ...	Twice watered by baling from well.	7	...	25th Jan. 1880.	76	4,400	...	...
			Coimbatore District.											
1	Red soil ...	·37	4 bandy-loads of manure and cattle were penned for 3 days.	11	26th Mar. 1880.	Twice weeded.	13 times ...	5	1	31st Aug. 1880.	158	...	176	676
2	Black soil ...	·10	Sheep were penned for 5 days.	13	20th Feb. 1880.	Once weeded.	4 do. ...	20	4	31st July 1880.	162	...	288	938
3	Red soil ...	·40	Sweepings, 4 cart-loads.	7	1st Mar. 1880.	Do. ...	5 do. ...	15	3	17th June 1880.	108	...	540	1,875
4	Do. ...	·50	Manure worth Rs. 6.	5	5th Mar. 1880.	Twice weeded	7 do. ...	20	4	20th do. ...	107	...	2,761	...
5	Black soil ...	1·00	Do. Rs. 4.	10	10th do. ...	Do. ...	4 do. ...	20	4	12th do. ...	94	...	4,324	...
6	Mixed soil ...	·50	.....	5	14th do. ...	Do. ...	6 do. ...	20	4	26th do. ...	104	...	432	...
7	Black soil ...	·25	.....	2½	20th do. ...	Do. ...	5 do. ...	20	4	24th do. ...	96	...	720	...
8	Mixed soil ...	·50	Manure valued at Rs. 6.	5	11th do. ...	Do. ...	6 do. ...	20	4	21st do. ...	102	...	374	1,450

28. *Reana Luxurians.*—Reports, on experiments made with this new crop have been received from the Chingleput and the Coimbatore Districts. In the former district from a quarter pound of seed Major Richardson, R.A., obtained an outturn of upwards of 6,000 lb. of green fodder equal to about 20 tons per acre. The ground was highly cultivated and was freely watered. He gave the fodder to the horses of his battery, and all, with two exceptions, ate it freely; but, as regards the nourishing properties of the fodder in feeding horses, Major Richardson's experience was unfavourable. However, instead of giving a small quantity of it in substitution, for a portion, or, in addition to, the daily allowance of grass, he attempted to substitute the Reana fodder for the grass, and, of course, being so very succulent and watery, the fodder produced ill consequences, specially when eaten too rapidly. In another experiment, made in the same district, also with a quarter pound of seed, the produce was 21 Madras measures of grain, and a cart-load (probably 800 lb.) of straw. The following details show the results of the experiment made in the Coimbatore District:—

Reana Luxurians.

Number.	General nature of Soil.	Area of Land sown.	Kind and Quantity of Manure used.	Pounds of Seed sown.	Date of Sowing.	Cultivation during growth of Crop.	Number of times irrigated.	No. of Inches of Rainfall and No. of Wet Days recorded at nearest Station during growth of Crop.		Date when Crop harvested.	Duration of Growth.	Outturn per Acre.		
								Wet Days.	Inches.			Green Fodder.	Grain	Dry Straw
						Coimbatore.								
1	Sandy.	ACRE. ·02	No manure was used as the land had been lying fallow for a long time, and was therefore fertile.	1	18th September 1880; date of transplanting 20th October 1880.	Weeds were removed on the 19th November 1880.	After the planting there were frequent rains; the land being close to a nullah it was always wet and hence no special watering took place.	20	18·74	28th Feb. 1881.	DAYS. 163	LB. ...	LB. 994	LB. 2,150

DISTRICT PLOUGHING TRIALS.

29. The only district in which any demonstrations in ploughing occurred with improved ploughs was Bellary, in which the Assistant Collector, H. A. Sim, Esq., conducted a number of successful experiments. He refers to them thus:—

"The ploughs were used on all sorts of land, both black and red, and hard and soft, and the exhibition was, I consider, a great success. The ryots seemed struck from the first with the ease and thoroughness with which the plough did its work; and, although at first there was some cavilling and the usual objections were made, this died out later on, and the superiority of the English plough was admitted by all, not only for the softer red soils, but also for the hard black cotton 'regada.' In one case black cotton soil, which had lain fallow for thirty years, and to plough which a native plough would have required six or eight pairs of bullocks, was turned up by the English plough with two pairs only."

* * *

"The native blacksmiths assert their ability to mend the English if broken.

"Fifteen ryots put down their names for ploughs, similar to the 15-rupee oak-handled one generally used by the Saidápet ploughman."

30. The ploughs used in the experiment were sent from Saidápet in charge of a ploughman who worked them during their experimental trials. The following extracts from the Tahsildar's notes on these trials are well worth perusal by all interested in the improvement of native husbandry:—

Result of Ploughing on 21st June 1880.

1. *Date.*—21st June 1880.
2. *Area ploughed.*—One-fourth of an acre.

3. *Nature of land.*—Sandu land, containing saline matters.

4. *Time.*—2 hours, 25 minutes.

5. *Time per acre.*—9 hours, 40 minutes.

6. *Kind of bullocks and plough.*—Four common Bellary bullocks. The oak-handled plough.

7. *Impressions of ryots, objections, &c.*—The ryots said that our plough did not go so deep as theirs did, and produced a stick 7 inches long to show the depth of their furrows. I went with them and measured their furrows in several places, and found a depth of only 5 inches on the average. I pointed out that our furrows were quite as deep and that, owing to the breadth of our furrow at botton, the quantity of earth raised was more than twice as great as theirs. A ryot named Chinnappa wants the loan of one of our ploughs for 2 or 3 days, in order that he may give it a thorough trial. No other objections were advanced.

BELLARY,
21*st June* 1880.

(Signed) J. G. FIRTH,
Tahsildar.

Results of Ploughing on 22*nd June* 1880.

1. *Date.*—22nd June 1880.

2. *Area ploughed.*—One-eighth of an acre.

4. *Time.*—One hour.

5. *Time per acre.*—Eight hours.

3. *Nature of land.*—Mosaba inclining to red soil. A little more than half of the land was extremely hard. In this portion the furrows cut by our plough were not more than 3 inches deep. In the softer portion (which was lower and had absorbed the rain) the furrows were 7 inches deep and the earth was turned up in a style that called forth the admiration of those looking on. One-eighth of an acre was marked out alongside of the piece we ploughed for the owner of the field to try his plough upon. The results of their ploughing proved much inferior to ours. They finished only one-third of $\frac{1}{8}$th acre in one hour, in which time ours was finished, and when the owner of the field said that our plough was superior to the "Madaka," he was asked whether it accomplished twice as much work as the Madaka, and he replied "three times as much." It was remarkable that the sharp snout of the "Madaka" made less impression on the hard soil than our ploughshare did. But when I removed the plough to a bit of red land close by, which I should have chosen for this morning's experiment only I had been told that it had been already ploughed this year, whereas it proved on inquiry to have been only harrowed with the "Guntaka" (flat iron bar $2\frac{1}{2}$ feet long and about $3\frac{1}{4}$ inches broad) and furrows of red earth 8 and $8\frac{1}{2}$ inches deep were turned up with ease by a pair of small-sized Bellary bullocks, the ryots became quite enthusiastic in their praises, crying "Wah! Wah!" in regular Hindustani fashion; and six of them asked me to put down the names for a 15-rupee plough each. They asked very particularly after a plough for deep ploughing in Regada land which is done with the "Pedda Madaka." The Madras ploughman said that such were used at the Saidápet Farm. I think that ploughs strong enough to take the place of the "Pedda Madaka" would be greatly appreciated by the ryots. Day after to-morrow morning I have promised to try what we can do with our plough on some Regada land belonging to the same ryot. (To-morrow no bullocks can be had, as it is a bullocks' feast-day.)

6. *Bullocks.*—Four ordinary Bellary bullocks were used, as the ryots said the ground was very hard and would require four bullocks. They also used four.

BELLARY,
22*nd June* 1880.

(Signed) J. G. FIRTH,
Tahsildar.

Results of Ploughing on 24*th June* 1880.

Area ploughed.—One-eighth acre.

Time occupied in ploughing.—56 minutes.

Time per acre.—7 hours, 28 minutes.

Nature of land.—Regada that had been ploughed with the great plough (Pedda Madaka) ten years ago, with the ordinary plough two years ago, and harrowed with the Guntaka (flat iron bar) last year. Owing to light showers yesterday and the day before, ground moist for about 3 inches.

Kind of bullocks and plough.—Four small Bellary bullocks. *Plough.*—The one with the bent oak handles, which the Saidápet ploughman seems to prefer to all the others.

The ploughing this morning was very satisfactory. Two separate portions of land, $\frac{1}{8}$th acre each, were measured out. We commenced ploughing with four small Bellary bullocks in one piece, and the owner of the land with four large bullocks and the ordinary Madaka in the other

piece. To my surprise our plough turned up the Regada with nearly as much ease as it did the "Yerra bhumi" (red soil) the day before yesterday. Our bullocks pulled steadily and without any visible strain or stress, while our competitor's bullocks tugged and jucked along with considerable difficulty, the Madaka sticking now and again, and having to be lifted to lessen the resistance. As our bullocks gained rapidly on the other four bullocks, Malyali Bhimanna, the owner of the field, grew quite excited, and crying out to his men "They beat us day before yesterday and they are going to beat us again"! He ordered another pair of bullocks to be attached to his Madaka, and, with six men to urge and whip them on, did his best to beat us in the ploughing match. But they failed. We finished our $\frac{1}{8}$th acre in 56 minutes, and they had still about $\frac{1}{8}$th of theirs to finish besides leaving about $\frac{2}{3}$rds of the land untouched in the ridges between the furrows. Chinnamma a ryot came out to see the ploughing and expressed herself as being pleased with it, but said she was disappointed as she had expected to see the plough work without any bullocks at all like "Poga bundi" (railway locomotive). After the match was over, the ryots asked us to plough across our $\frac{1}{8}$th acre, and to please them we ploughed a few cross furrows which astonished them by going down about a foot in depth and turning up a large quantity of earth. Afterwards on some fresh ground we put six bullocks on to our plough and turned up the earth to a depth of 9 inches with ease. I promised the ryots to try to-morrow some Regada land that has not been ploughed for twenty years.

Our ploughing to-day has been a grand success I am glad to say.

BELLARY,
24*th June* 1881.

(Signed) J. G. FIRTH,
Tahsildar.

To-morrow's ploughing north of the jail near the small hamlet called Mhanandi Kottam.

(Signed) J. G. F.

Ploughing Report, 25th June 1880.

Area ploughed.—One-eighth of an acre.
Nature of land.—Regada that had lain fallow for 30 years.
Time.—One hour.
Time per acre.—Eight hours.
Bullocks.—Four ordinary Bellary bullocks.
Plough.—The oak-handled plough.

To-day a ploughing match again took place in which our plough was beaten, the native plough having finished the $\frac{1}{8}$th acre in 45 minutes. But we were not beaten fairly. In his eagerness to reanguish us Bhimanna used a light plough which only penetrated about $4\frac{1}{2}$ to 5 inches, and his furrows were wider apart than usual. His four bullocks also appeared to be stronger than ours. The ryots all admitted that the work performed by their plough would bear no comparison with ours.

This experiment was very satisfactory, as the natives doubted very much the suitableness of our ploughs for breaking up fresh Regada land. Indeed the Saidápet ploughman, who had been sent to inspect this very land, had reported that our plough could not plough it, and it would require a heavier and stronger plough. But this morning's experiment satisfied the ryots that our ploughs could turn up Regada as well as other land. The piece of ground selected had two patches of Nutt grass, and the roots of the grass came to the surface freely, showing that with a larger and heavier plough we could plough deep enough to thoroughly eradicate the Nutt and Hurriali roots which give so much trouble to the ryots. No objections were made to-day.

(Signed) J. G. FIRTH,
Tahsildar.

Ploughing on the 26th June 1880.

Area ploughed.—One-eighth acre.
Time.—57 minutes.
Nature of land.—Red soil, light, and friable.
One acre.—7 hours, 36 minutes.
Bullocks.—Two good Bellary bullocks.
Plough.—The oak-handled plough.

The land was ploughed up with ease. After the $\frac{1}{8}$th acre was ploughed, tried the English harrow with which the ryots seemed pleased. No objection was made against the plough except the stock one of the difficulty of repairing it if broken or injured. While the ploughing was going on I overheard the Reddi of Horgandoni say to another ryot that the work done by the two bullocks was as good as could be got out of six bullocks with the native plough.

In conclusion I would earnestly request that a large plough capable of turning up the land to a depth of 15 inches, if not at the first ploughing at least at the second or cross-ploughing, may be sent to Bellary. The ryots are very anxious to see one; and if an efficient plough of this kind could be had for about 30 rupees, I think a large number would be applied for and would prove a great boon to the ryots, as it is stated to cost 5 to 10 rupees per acre to break up and prepare for sowing fresh Regada land.

(Signed) J. G. FIRTH,
Tahsildar.

26th June 1880.

THE MADRAS ANNUAL PLOUGHING MATCH.

31. This was held on a piece of ground situated within the Municipal limits of Madras. The land was covered by grass, the soil, a stiff one, not having been tilled for a dozen years or more, was hard and compact, and therefore well suited for testing the capabilities of the ploughs. There were 26 competitors of whom 19 used native ploughs, the remainder ploughs of the European pattern. The native ploughs generally failed to do more in one operation, than to stir the surface of the ground to a depth of 2 or 3 inches; they occupied on the average about 2 hours in going over each plot, measuring one-tenth of an acre, and the judges awarded very low marks. The ploughs of the European make performed very good work indeed. One competitor with one of these ploughs was awarded by the judges 97 per cent. of the full marks; he, when ploughing to a depth of 6 inches, completed his plot, also a tenth of an acre in extent, in one-and-a-half hours. The general opinion of those who attended the match was, that native ploughs had not the least chance in competition with European ploughs, in turning over such hard grass covered soil as that, on which the match was held. Much interest was taken in the match by the general public. A separate detailed report having been published, further remarks seem unnecessary.

EFFORTS IN IMPROVING NATIVE HUSBANDRY, BY A MIRASIDAR OF TANJORE.

32. The following interesting report, which is well worth perusal, has been sent to me by M.R.Ry. C. Kristnasawmy Mudaliar, a Mirasidar of the Tanjore District. The report explains very fully the difficulties he has encountered in his efforts to better matters. He is to be congratulated on the large measure of success he has secured. I am convinced that, the efforts of Government to improve native husbandry, would be attended with very much greater success than they have hitherto had if, the large landed proprietors of the Presidency could but be interested in the work, and induced to do their part, towards securing the improvement, so greatly to be desired:—

From C. KRISTNASAWMY MUDALIAR, Shiyáli, to W. R. ROBERTSON, Esq., M.R.A.C., Superintendent, Government Farms, Saidápet, Madras, dated 8th July 1881.

At about 3 miles from Shiyáli there are two villages called Aroor and Thathangoody. In these villages my father purchased 15 years ago 144⅔ acres of land for Rupees 15,000, of which 85 acres are in Aroor and 59⅔ acres in Thathangoody.

The village Aroor consists of 193⅓ acres in extent, whereof 180 acres are wet lands, while the remaining 13⅓ acres consist of 2 or 3 elevated patches taken up for habitation, &c.

And the village Thathangoody consists of 135 acres, of which 130 acres are wet lands and the remaining 5 acres being taken up for habitations, &c.

The village Aroor is somewhat better irrigated by a channel branching from the river Coleroon than the village Thathangoody which has only very precarious and uncertain supply of water from a channel branching from a drainage river Palanar.

The soil in both the villages from the surface to a depth of 4 or 5 feet is of a dense clay and the soil below is sandy. A thin flow of subterranean water in the sand below a depth of 7 or 8 feet from the surface is obtainable during the hot season.

These lands came under my management about five years ago, and from the time of purchase they yielded hardly any profit.

As many other villages are laboring under similar disadvantages, and reference to the accounts of the past years show that the yield has been gradually declining, I determined to take up the cultivation of the Aroor and Thathangoody lands under my direct management, and ascertain experimentally what should be done to remedy the evils.

I herein give the routine practices of agriculture followed in the villages of this taluk.

The wet lands as a rule are given to the under-tenants or Parakudies, who cultivate for varum (a share in the produce), and the varum in these villages is 30 per cent. of the produce.

In addition to the above-mentioned varum, they also enjoy a piece of land as Inam, and hold punja or dry lands, if there be any, on a low rent.

During the season of cultivation a premium of paddy for seeds and wages is given to the under-tenants or Parakudies, and the amount of these items is deducted from their varum payable on the outturn.

Some servants as thotti, waterman, carpenter, blacksmith, &c., and the Pagoda Brahmin priesthood, &c., are maintained both by Inam and also a share in the produce.

From the month of August the supply of water is obtained from the river, and the Parakudies or undertenants after a period of rest during the hot season get a loan from the Mirasidar to purchase the cattle lost by disease, &c., in the previous year, and to get some wood and purchase mammatte-blades from the bazaar, and carry them to the carpenter and blacksmith who make and give them mammatte and plough.

In the month of August the seed-beds of kar varieties are sown, and in September the seed-beds of sumba varieties are sown, and kar varieties are transplanted. Kar fields form only $\frac{1}{8}$th or $\frac{1}{9}$th of the extent of the wet lands in the village, and the rest are transplanted with sumba varieties, and the sumba transplantation extends over October, November, and sometimes even *December*.

In November and December the kar varieties are harvested, and in February and March the sumba varieties are harvested.

Four to five ploughings are given for the puddling, and no manuring is practised, and the paddy plants are weeded once.

This system has long been followed and has produced several evils.

The Parakudies and servants who were almost slaves in former days have gradually grown idle by the abolition of slavery by the British Government, and neglected their duties because they have no corporal punishment as they had before.

The yield of the land became gradually reduced, and it now ranges only in such amounts that it is scarcely possible for a Parakudi even to pay back the stipulated advances they obtain from the Mirasidar during the cultivation.

The following account of a Parakudi shows the condition in which the agricultural laborers in this taluk stand :—

A Parakudi cultivates with a pair of cattle 4 acres of wet lands, and the yield of 4 acres now ranges on average from 80 to 90 kulums. Therefore the share or varum of the Parakudi ranges from 25 to 30 kulums.

For this the items of advances they get are as follow :—

	Kulums.
Seed at $2\frac{1}{2}$ kulums an acre	10
Cultivation expenses at 2 kulums an acre	8
New Year's day and other festivals, &c.	3
Total ...	21

The remaining 5 or 10 kulums he gets at the harvest time, which together with 5 to 10 kulums which he gets from the Inam lands, is recklessly spent at the very harvest season.

Thus he miserably exists for more than five or six months in the year, and feasts sumptuously in one or two months.

But if the account of the Parakudi were to be settled, taking the loans they get for cattle purchase, marriage, &c., together with the cultivation premium, it would leave no margin of profit, but only leave an addition to their old debt.

Therefore the annual income of a Parakudi, including the Inam and wages, will never exceed 30 or 35 kulums, unless they obtain by petty thefts and pilfering something more. Consequently the Parakudies are in no way better than the cattle, and they really starve bitterly for many months as they recklessly consume away the little stock they secure during the harvest season.

Thus in the whole of my estate I can find only a very few Parakudies who are not indebted to me in hundreds of rupees.

I find it universal custom with the Parakudies to appropriate for their own private use a portion of the seed and the cattle purchase money in collusion with the village agents and purchase worthless cattle, unfit for work, which scarcely last for a single year, and the death of the cattle consequently comes up every year to awful percentage, and thus I am obliged to spend annually a large sum of money in cattle purchase.

Therefore the Parakudi system rendered the working class ignorant, negligent, and untrustworthy paupers, and I find it totally impossible to attempt at any improvement without altering the present system.

In the year 1879, I attempted to abolish the Parakudi system in the Aroor and Thathangoody villages, as they situate at a convenient distance from my place of residence, and at the same time as they are not in the centre of my villages to apprehend the creation of any unpleasant feeling on the part of the laborers likely to lead to a general confusion in other villages at the outset.

I relieved the working class from the worthless contract and brought them as daily laborers, allowing them the enjoyment of the Inam lands.

I withdrew the Inam of the servants and the pagoda and other institutions, and made them to receive the monthly payment.

I took a few worthless cattle left with the Parakudies, crediting their value to their account, and purchased a number of good country cattle, constructed and purchased ploughs and other implements, and appointed trustworthy agents to conduct the process of cultivation operations under my direct supervision.

I built cattle-sheds and other necessary buildings, regulated myself the food for the cattle, and made arrangement for their sanitation, treatment, &c.

I now find all the cattle, with the exception of those taken from the Parakudies, fit to work with light improved ploughs and with carts, and the great percentage of their mortality is not felt for the last two years.

The following table shows the total outturn and the cultivation expense of the Aroor and Thathangoody villages for the past fifteen years :—

Year.	The Total Produce.					The Total Cultivation Expense.					Profit and Loss.
	Paddy in Kulums of 24 Madras Measures.	Market Rate.	Money Value.	Value of the Straw and Manure, &c.	Total.	Seeds and Wages in Kulums.	Money Value.	Expense in Cattle-keep, &c.	Kist.	Total.	
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1866	3,198½	1 7 0	4,297 10 0	150 0 0	4,447 10 0	1,403½	2,017 8 6	600 0 0	683 8 7	3,301 1 5	+ 1,146 8 7
1867	3,431⅝	1 0 0	3,431 10 0	160 13 6	3,592 7 6	1,559⅜	1,559 6 0	610 13 6	696 1 1	2,865 14 7	+ 726 8 11
1868	1,968⅞	1 5 0	2,584 10 6	92 4 7	2,676 15 1	1,305⅝	1,713 10 1½	392 4 7	710 0 0	2,815 14 8½	— 138 15 7½
1869	3,157¼	0 15 6	3,058 9 4½	128 0 0	3,206 9 4½	1,648¼	1,596 11 10½	428 0 0	710 0 0	2,784 11 10½	+ 491 13 6
1870	2,718½	0 12 3	2,081 5 7½	127 6 11½	2,208 12 7	1,373¾	1,051 12 6	427 6 4½	710 0 0	2,189 2 10½	+ 19 9 5½
1871	2,539¾	0 15 9	2,500 1 0	119 1 0	2,619 2 0	1,402⅜	1,380 7 6	419 1 0	710 0 0	2,509 8 6	+ 109 9 6
1872	2,687⅝	0 15 10½	2,666 10 0	125 15 6	2,792 9 6	1,370⅝	1,359 14 9	425 15 6	710 0 0	2,495 14 3	+ 296 11 3
1873	2,603½	1 1 9½	2,895 0 7½	122 0 7½	3,017 1 3	1,231	1,368 13 6½	422 0 7½	710 0 0	2,500 14 2	+ 516 3 1
1874	2,266	1 0 0	2,266 0 0	106 4 0	2,772 4 0	1,228	1,228 0 0	406 4 0	710 0 0	2,244 4 0	+ 528 0 0
1875	...	...	...	...	...	...	...	...	...	...	...
1876	2,345½	1 12 7	4,190 0 2½	109 15 0	4,299 15 2½	1,072½	1,294 9 11½	409 15 0	710 0 0	2,414 8 11½	+ 1,775 7 0½
1877	1,969	1 15 0	3,804 15 0	92 4 9	3,897 3 9	1,322½	2,727 10 6	392 4 9	710 7 0	3,830 6 3	+ 66 3 0
1878	2,666½	1 12 6	4,749 11 3	125 0 0	4,874 11 3	1,297⅛	2,370 7 1	425 0 0	710 0 0	3,445 7 1	+ 1,304 4 2
1879	2,423¼	1 3 1	3,041 10 11¼	113 9 6	3,155 4 5¼	1,303½	1,736 2 7½	324 13 4	719 5 5	2,780 5 4½	+ 375 15 1½
1880	2,762	1 0 0	2,762 0 0	222 10 0	2,984 10 0	1,317	1,317 0 0	606 2 10	728 2 0	2,651 5 10	+ 333 5 2

As both the villages Aroor and Thathangoody situate close together, the cultivation operations are carried on as if they are one and the same village.

In 1880 the village Thathangoody, as almost in every year, suffered severely from want of water during September and the early part of October just at the time of the transplantation, and the fields transplanted as well as those to be transplanted became thoroughly dried and cracked, so as to be worked again and transplanted.

The surface-dried clay did not come again to the soft condition, and the seedlings became too aged and nodded, and consequently the yield was very low.

Thus the average yield per acre in the village Aroor is $27\frac{3}{16}$ kulums of paddy and 27 loads of straw worth Rs. 28-14-0, and the average yield per acre in the village Thathangoody is $12\frac{1}{2}$ kulums of paddy and $9\frac{1}{2}$ loads of straw worth Rs. 13-1-6. The cultivation expenses, inclusive of kist in both the villages, is Rs. 20-0-3. Therefore the loss per acre in the Thathangoody village is Rs. 6-14-9, and the profit per acre in the Aroor village is Rs. 7-2-9. Therefore the profit on the whole for both of the villages per acre is Rs. 2-7-$10\frac{1}{2}$.

The Field Experiments.—The experiments conducted this year include the determination on the effect of—

(1) Deep cultivation and inversion of soil.
(2) Farm yard manure.
(3) Bone ash.

The paddy in the wet lands is the crop on which the experiments were made.

I was able to conduct only a very few experiments this year, because—

(1) Much of the time and attention I was able to devote in agricultural improvements was spent in bringing the laborers in the experimental village to proper order who totally disliked their idle system to be altered and substituted.

(2) The wet lands in the experimental villages, as all other villages in the taluk, suffered severely both from drought during September and submersion during December owing to the imperfect arrangement of irrigation and total absence of drainage.

None of the fields experimented were manured in the previous years.

The Cost of Cultivation.—The data given below concerning the cost of cultivation have been determined by actual measurement and represents the cost per acre of each operation carried on by hired labor under supervision not of a very strict nature.

Cost of Operations.	Per Acre. RS. A. P.
Ploughing by light improved iron ploughs	1 12 0
Do. by the country plough for the 1st ploughing	1 11 0
Do. by the country plough for the 2nd, 3rd, and 4th ploughing	0 12 0
Raising the seedlings	0 8 4
Digging and bordering	0 6 4
Transplantation	0 7 9
Weeding	0 4 7
Irrigation	0 4 5
Harvest	2 6 0
Inam	0 14 0
Static Works	0 10 1
Superintendence	2 1 9

Cost of Manures.	Per Cart-load. RS. A. P.
Farm yard manure	0 5 0

	Per Candy. RS. A. P.
Bone ash	2 8 0

Cost of Seeds.	Per Kulum. RS. A. P.
Kar Seeds	1 4 0
Sumba	1 10 0

Experiment on the Effect of Deep Cultivation and Inversion of Soil.

Plot.	Area.	Treatment of the Crop.					Previous Treatment.	Outturn.				Cost of Cultivation including Kist per Acre.	Value of Produe according to Market Rate per Acre.	Profit per Acre.
		Ploughing.	Manuring.	Transplantation.	Irrigation.	Miscellaneous.		Actual.		Rate per Acre.				
								Grain in Kulums of 24 Madras Measures.	Straw in loads of 82 lbs.	Paddy.	Straw.			
	ACRE.											RS. A. P.	RS. A. P.	RS. A. P.
1.—Experimental Field.	6¾	In August watered and ploughed once by the iron plough to a depth of 7 inches, and in September again ploughed once by the country plough.	Not manured.	In September transplanted with kalian seedlings raised from 10 kulums of seeds.	The field was watered before ploughing and kept under water up to harvest.	Weeded once in November.	Not manured and Samba paddy grown as usual.	190	160	28½	24	18 10 3	30 0 0	11 5 9
2.—The adjoining Field.	3⅓	In August watered and ploughed by the country plough twice, and again in September twice by the same plough.	Not manured.	In September transplanted with seedlings raised from 5 kulums of seeds	The field was watered before ploughing and kept under water up to harvest.	Weeded once in November.	Not manured and Samba paddy grown as usual.	75	57	22½	17	20 0 3	23 9 0	3 8 9

	In Grain.	In Straw.	In Profit.
Percentage of Increase	26·6	41	220

II.

On the Effect of Farm-yard Manure.

Plot.	Area	Treatment of the Crop.					Previous Treatment.	Outturn.				Cost of Cultivation including Kist per Acre.	Value of Produce according to Market Rate per Acre.	Profit.
								Actual.		Rate per Acre.				
		Ploughing.	Manuring.	Transplantation.	Irrigation.	Miscellaneous.		Paddy in Kulums of 24 Madras Measures.	Straw in Loads of 82 lb.	Paddy.	Straw.			
I.—Experimental Field.	3⅜ Acres.	Watered and ploughed twice in August by the country plough, and again twice in September by the same plough.	100 cart loads of pit manure were applied just before the field was flooded.	* In September transplanted with sumba seedlings raised from 5 kulums of seeds.	Watered in August before ploughing and kept under water up to harvest.	Weeded once.	Not manured and sumba paddy grown as usual.	100	150	30	45	RS. A. P. 23 12 3	RS. A. P. 32 13 0	RS. A. P. 9 0 9
II.—Adjoining Field.	3⅜ Acres.	Do.	Not manured.	Do.	Do.	Do.	Do.	75	57	22½	17	20 0 3	23 9 0	3 8 9

* The seedlings being planted too close.

	In Grain.	In Straw.	In Profit.
Percentage of Increase	33·3	164·6	255

As is usual in this taluk it yielded much straw and little grain.

III.

On the Effect of Bone Ash.

Plot.	Area.	Treatment of the Crop.					Previous Treatment.	Outturn.				Cost of Cultivation including Kist per Acre.	Value of Produce according to Market Rate per Acre.	Profit per Acre.
								Actual.		Rate per Acre.				
		Ploughing.	Manuring.	Transplantation.	Irrigation.	Miscellaneous.		Grain in Kulums of 24 Madras Measures.	Straw in Loads of 84 lbs.	Grain.	Straw.			
I.—Experimental Field.	½ Acre.	In July watered and ploughed 3 times by the country plough, and in August twice by the same plough.	375 lb. of bone ash applied at the time of transplantation.	In August transplanted with kuruvi seedlings raised from ⅔ kulums or 18 Madras measures of seeds.	Watered in July and kept under water up to harvest.	Weeded once in September.	Not manured and kar paddy grown as usual.	30	15	60	30	RS. A. P. 22 0 3	RS. A. P. 61 14 0	RS. A. P. 38 13 9
II.—Adjoining Field.	1 Acre.	Do.	Not manured.	In August transplanted with seedlings raised 1½ kulums of the same seeds.	Do.	Do.	Do.	34½	28	34½	28	20 0 3	36 4 0	16 3 9

	In Grain.	In Straw.	In Profit.
Percentage of Increase	75·3	7·1	239·3

EXPERIMENTS TOWARDS THE INTRODUCTION OF IMPROVED IMPLEMENTS.

I. *Ploughs.*—I have purchased this year from the Madras and Cawnpore Government Farms a number of ploughs and experimented both in wet and dry lands towards their introduction in this locality.

(1) *Nawab plough.*—This plough I purchased from the Cawnpore Government Farm; it resembles the country plough, consists of working parts made of iron in the improved fashion having mould-board and share, so as to loosen and at the same time inverts the soil, and to this working part an upright handle and a rigid beam to which the cattle is yoked. This plough is very light, weighs 20 lb., costs Rupees 6. It can be conveniently carried on the shoulders; moreover the management of this plough requires only a little more intelligence and special instructions on the part of the ploughman. It ploughs in the wet land about one-third of an acre to a depth of 4 to 5 inches in a day of six hours.

This plough I think can be best substituted for the country plough in the wet lands.

(2) *Kuizan plough.*—I have purchased this plough also from the Cawnpore Government Farm; it is constructed after the model of the light American combined plough, has no wheel or coultor, and is attached to the yoke by a rope fastened to the ring at the end of the beam is very light, weighing only 28 lb., and costs Rupees 6. The adjustment of this plough is rather difficult on the part of the ploughman here. It ploughs about one-third of an acre in loose friable soils, but in clayey wet lands fails to work.

(3) *Light American combined plough.*—I have purchased two samples of this plough from the Madras Government Farm, one of which is with an upright mould-board and the other with an elongated mould-board.

The one with an upright mould-board weighs 45 lbs., costs Rupees 9. Fails to work in clayey wet lands, but works well in loose friable soil.

The other weighs 52 lbs., costs Rupees 12. Works tolerably well with the ordinary cattle in wet lands, as well as in dry lands; but however the draught is not less than that of the light iron plough and at the same time the work done is not so good as that done by the light iron ploughs.

(4) *Light Swedish iron plough with one stilt.*—This plough is an iron plough manufactured in the Madras Government Farm after the Swedish model, weighs 70 lb., costs Rupees 20. This plough works well with somewhat better breeds of cattle both in dry and wet lands. It ploughs in wet lands one-third of an acre to the depth of 6 to 8 inches, and in dry lands more than half of an acre in a day of six hours.

I have also purchased three more ploughs from the Madras Government Farms, one of which is a large Swedish plough and the other two B. F. I. of Ransomes Head and Jefferies, but as I received them after the ploughing season, I have not experimented them as to their utility in this locality.

Reaping knife.—The reaping knife used here in cutting down the ripe paddy plants, &c., is in the form of a semi-circular; it has serrated edges; it is very light, weighing only ¾ lb. with the handle.

Therefore the plants are cut down by the expense of much force aided by the serration in the edge; moreover the knife in cutting the plants jerks and cuts high and catches only a very few plants. A large portion of the straw is thus wasted, left in the field in the form of stubbles.

I purchased from the Madras Government Farm a sample knife which has the form of a curve at the base and lengthened at the end. This knife is weightier, weighing 1½ lb. It catches more plants and cuts closer to the ground.

I have made some knives here of this sample and experimented with them.

A man with this knife cuts down paddy plants in an area of one-third of an acre, leaving the stubble only to the height of 2 to 3 inches, whereas with the ordinary knife cuts down the same extent, leaving the stubble to the height of 6 to 12 inches.

Coolies not being trained to handle this improved knife, some of them sometimes stupidly jerk the knife as they do with the ordinary knife and cut their left hands, but I think if the coolies become accustomed they won't be liable to such mistakes and the work will be facilitated.

III. *Winnowing machine.*—Cleaning the seed from the admixture of unfertile grains, chaff, dirt, &c., and selecting the good ones for seeding purposes, seems to be very essential, because owing to the drought, submersion and imperfect cultivation a larger percentage of the grain in the produce are only imperfectly developed ones, and these, when sown without separation, only the plants of a like nature germinate which die sooner or later from casualties or yield a very inferior crop.

The ordinary process of winnowing followed here is exposing the seeds to the wind, which operation effects only a very imperfect separation and is very precarious.

The process of separation by moram and salladai, made of bamboo, clean the seeds well from the admixture dirt, unfertile grains, &c.

This process, however, being very slow and tedious, is only used by women with paddy for husking.

In the last May I applied to the Madras Government Farms for a sample of winnowing machine; the then Superintendent replied that the Government did not allow the manufacture and sale of the implements and tools in the Government Farm. I then applied to the Cawnpore Government Farm for a sample of winnowing machine, and obtained from them a machine at a cost of Rupees 30.

I experimented and found that by the assistance of this machine three men clean about 30 kulums of paddy-seeds in a day of eight hours' work, but a complete separation of the seeds from the impurities is not effected in a single process, and it requires to repeat the process more than once. Moreover the working of this machine requires the application of great force on the part of the workmen.

In the last January I purchased from the Madras Government Farms a winnowing machine of Dray, Taylor, and Co., London, for Rupees 80.

I experimented and found that by this machine three men clean about 80 kulums of paddy-seeds in a day of eight hours' work.

A complete separation from the impurities is effected in a single process.

As to the amount of advantage in the selection of seeds for sowing purposes, I have not experimented this year, as I have received this machine after the sowing season.

CATTLE.

I am thoroughly convinced as to the vital importance of keeping the cattle under my direct management by the results of the experiments I have made in my experimental village.

Throughout the year, a regular shed against the inclemencies of the weather, good and wholesome food containing all the essential ingredients, sanitary arrangement and medical assistance are all indispensable requisites for the well-being of the cattle.

Under the present state of circumstances none of these the cattle could get from the hands of the Parakudies.

(1.) The Mirasidars invariably employ other coolies in conducting the harvest, who cut the ripe paddy plants close to the ear, leaving large portion of the straw in the form of stubbles. Again, these Parakudies during the period of their own starvation sell for their food whatever they have in their hand, and leave the cattle miserably to starve and die.

(2.) The Parakudies who are so ignorant as not to feel the want of proper sheds for themselves can never be expected to provide sheds for the cattle under their charge.

(3.) It is impossible to inculcate the principles of sanitation and proper medical aid to the Parakudies, and I think if the Mirasidars could restrain themselves from giving cattle to the Parakudies, it will materially improve the sanitation of the huts of the miserable Parakudies themselves.

Therefore if the Mirasidars pay a little attention at the time of harvest and cut the plants closer to the ground, leaving only 1 or 2 inches of stubble and preserve it without giving into the hands of the Parakudies sufficiency of straw can be had throughout the year.

A little additional expense in purchasing the oil-cake, bran, or inferior food-grains, &c., to add to the general food the paddy straw, will not come even to one-fourth the sum of money, which the Mirasidars do annually give for the purchase of cattle or *Mattoo Varagum*.

The erection of permanent sheds for the cattle of course involves considerable expense on the part of the Mirasidars, but however this will never exceed two years' cattle purchase money, and the Mirasidars can conveniently afford to have a portion of their capital laid out in the construction of permanent buildings for the cattle.

The following table shows the account of the cattle for the villages of Aroor and Thathangoody for the year 1880-81:—

The Number and Valuation of the Cattle on 30th June 1880.		The Number and Valuation of the Cattle died during the Year.		The Number and Valuation of the Cattle purchased during the Year.		The Total Cost of the Food and Attendance, &c., of the Cattle during the Year.	The Number and Valuation of the Cattle sold during the Year.		The Number and Valuation of the Cattle on 30th June 1881.	
NO.	RS. A. P.	NO.	RS. A. P.	NO.	RS. A. P.	RS. A. P.	NO.	RS. A. P.	NO.	RS. A. P.
37	625 0 0	7	78 12 0	12	250 4 0	536 1 0	...	...	42	640 0 0

Reference into the accounts of the past fifteen years shows that the total expense of the cattle keep per year under the Parakudi system never goes below Rs. 450.

This year in these villages the expense is only Rs. 536-1-0, a little more than the average rate of expense under the Parakudi system.

Out of 42 bullocks 12 bullocks are employed in ploughing with light improved ploughs, carting, and other purposes, and their extended labor throughout the year have greatly reduced the cost of keep.

In the Arachoor Bisgah of my estate which consists of four full villages extending about 1,000 acres, I refused to sanction money for cattle purchase since the year 1879, and purchased the cattle myself to make up the number lost by death and kept a portion of the cattle purchased under my direct management and gave the rest to the Parakudies.

I allowed those Parakudies whom I permitted to carry on the cultivation operations with the cattle under my management all their inams and wages as usual in the Parakudi system excluding only the straw.

Thus for the year 1879 I had about 150 cattle under my management, and for the year 1880 their number increased to about 200, and as the consequent result the mortality in the cattle under the direct management is greatly reduced, while those of the Parakudies ranged in the usual percentage. Moreover the working capability and valuation increased in the same way while in those of the Parakudie's decreased.

The chief difficulty in bringing about changes in the agricultural practices of the country lies in the unwillingness of the under-tenants or Parakudies.

One object of rational agriculture being to economize labor, the Parakudies or under-tenants are afraid that they will be thrown out of service and oppose the introduction of salutary changes.

In such cases the Mirasidars or the land-owners are obliged to dismiss them and also to eject them, which however they cannot do without the intervention of the Civil Courts. The procedure is costly and the delay long and unavoidable.

EXCHANGES.

33. The following publications were received in exchange for those of this department during the year :—

Records of the Geological Survey of India.
Proceedings of the Horticultural Society of India, Calcutta.
Proceedings of the Horticultural Society, Madras.
Report of the Department of Agriculture and Commerce, North-West Provinces and Oudh.
Report on the Cawnpore Experimental Farm ; Rabi Season 1879-80.
Report on the Arboricultural Operations in the North-West Provinces and Oudh, 1880.
Report on the Horticultural Garden, Lucknow.
Annual Report on the Government Experimental Farm, Cawnpore, for 1878-79.
Journal of the Royal Society of Edinburgh.
Journal of the Highland and Agricultural Society of Scotland, Edinburgh.
Journal of the Royal Agricultural Society of England.
Journals of the Society of Arts, London.
Annual Report of the Commissioner of Agriculture, United States, America.
Report of the Acclimatization Society of Queensland, Brisbane, 1880.
Report of the Botanical Garden, Brisbane.
Report on the Progress and Condition of the Botanical Garden and Government Plantation during the year 1879, Adelaide.
Agricultural Statistical Reports from the Department of Agriculture, Italy.

DEPARTMENTAL.

34. During the greater part of the year under report the charge of the department was in the hands of Mr. Benson, who had been appointed to officiate for me during my absence on furlough in England. The general work of the department has been carried on on the same system as during previous years. Mr. Benson has

adhered generally to the plans I had in view regarding the general direction of our work, and has successfully performed the duties entrusted to him, which, at times, have been difficult and arduous, arising to a considerable extent from the absence of efficient assistance, Mr. Schiffmayer having been absent for a considerable time on sick leave; while Mr. Benson himself suffered from ill-health during a considerable part of the year. I returned from furlough on the 29th of November last when I took over charge from Mr. Benson, and he took charge of the farm for a few weeks, when he again gave over charge to me on his being granted two months' leave of absence. On the expiration of his leave, Mr. Benson again resumed charge of the farm. During the year Mr. Schiffmayer continued to suffer from ill-health. He was absent 5 months on sick leave.

The office-work continues to demand a considerable amount of attention. During the year upwards 1,500 letters were issued. The office arrangements are not as satisfactory as they might be; too great a proportion of my time and of that of my Assistants being absorbed in office-work of an unimportant character; but I shall submit separately some suggestions in view to obviate or lessen this evil, for the management of the School of Agriculture, the duties of the Agricultural Lectureship in that Institution, the time absorbed in conducting out-of-door classes of students has, together, formed a large addition to our work, while, no additional assistance has been granted.

35. *Finances.*—The following abstract statement shows the income of the department and the expenditure on various objects during the year; details are given in the Appendix :—

	Rs.	A.	P.		Rs.	A.	P.
Balance on the 1st April 1880.	2,39,112	9	8	*Expenditure.*			
Receipts.				General Supervision	17,195	8	0
Provincial Grant	20,000	0	0	Saidâpet Experimental Farm.	7,637	6	0
Surplus Pound Fund ...	40,923	14	1	School of Agriculture ...	15,401	2	1
Saidâpet Experimental Farm.	3,824	11	5	Estate Charges and Improvements	3,531	4	7
School of Agriculture (Rents, sale of Class Books) ...	177	15	5	Balance in favor of the Department on the 1st of April 1881	2,60,273	13	11
Total ...	3,04,039	2	7	Total ...	3,04,039	2	7

(Signed) WILLIAM. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms, Madras.

SAIDAPET,
July 30th, 1881.

APPENDIX.

STATEMENT OF THE ACCOUNTS OF THE MADRAS AGRICULTURAL DEPARTMENT, FOR THE YEAR 1880-81.

Expenditure—

	RS.	A.	P.	RS.	A.	P.
I. General Supervision—						
Establishment	14,786	11	0			
Travelling charges	290	2	4			
Stationery	315	10	0			
Exhibition of Improved Ploughs	28	3	7			
Ploughing Competition	328	2	3			
Contingencies	1,246	0	6			
Surgeon for Medical Charge	200	10	4			
				17,195	8	0
II. Saidápet Experimental Farm				7,637	6	0
III. Educational (School of Agriculture)—						
Establishment	3,908	6	0			
Stipends and Scholarships	2,495	7	1			
Lecture Fees	6,980	0	0			
Books	191	4	1			
Prizes	63	8	0			
Gymnastic Instructor	240	0	0			
Chemicals and Laboratory Apparatus	162	8	3			
Botanical Garden	752	6	4			
Contingencies	476	3	10			
Maintenance of Buildings	131	6	6			
				15,401	2	1
IV. Estate Charges and Improvements—						
Repairs to Buildings	941	9	8			
Trees and Planting	201	8	6			
Manufacture of Drain Pipes and Subsoil Drainage	57	13	6			
Brick and Mortar Bridges	307	14	2			
Extension to Water Channels	302	5	3			
Repairs to Roads	238	6	6			
Sundry work and alterations	384	1	2			
Maintenance of Superintendent's Quarters	229	0	5			
Alterations to Farm Bungalow	316	1	10			
Repair of Western Channel Bridge	552	7	7			
				3,531	4	7
				43,765	4	8
Adjusted balance at the beginning of the year	2,39,112	9	8			
Income—						
Provincial Grant	20,000	0	0			
Receipts from the Surplus Pound Fund during the year 1880-81	40,923	14	1			
Saidápet Experimental Farm as per Statement given in Appendix	3,824	11	5			
School of Agriculture (Rents and sale of Class Books	177	15	5			
				3,04,039	2	7
Balance in favor of the Department on the 1st of April 1881.	2,60,273	13	11			

(Signed) WILLIAM. R. ROBERTSON, M.R.A.C.,
Superintendent, Govt. Farms, Madras.

Resolution—dated 5th December 1881, No. 3059.

THE Board submit to Government their general report of the operations conducted by the Superintendent of Government Farms for the year 1880-81, in accordance with G.O., dated 30th April 1879, No. 663, Public.

2. The weather at the Saidápet farm during the cropping season was, on the whole, favorable. In addition to the ordinary crops, Planter's Friend, Chinese sugar-cane, and Madagascar paddy were grown. The ordinary cereal fodder crops did not yield well, but leguminous crops gave satisfactory results. The first crop of irrigated cereals was good, but the second ("Car" paddy) suffered from insufficiency of water. On the whole an average outturn of 1,594 lb. of grain and 4,033 lb. of straw were secured to each acre. The yield of cotton crops varied from 363 lb. down to 159 lb. of seed-cotton, the crops being grown with a cereal crop interspersed. Modifications were effected in this latter practice. Arrow-root was grown and the yield was from 4,000 lb. to 7,500 lb. of tubers per acre; the latter rate represents a value of Rs. 400 per acre. Sugar-cane grown on a plot was crushed by means of the Beehea Sugar Mill newly introduced at the farm with satisfactory results. Experiments were made in growing and curing tobacco, but, though the article produced showed much improvement over what had been effected in previous years, it was still, owing to its poverty in salts of potash, unfitted for the European market. Experiments in manures have been begun at Saidápet on a set of plots set apart for the purpose. The Aden cows continued to give good results as to the yield of milk. The Punganúr cows, which have a local reputation, were found by the Superintendent to be unable to compete with the Aden cows. Sheep-breeding experiments progressed satisfactorily, and some half-breed Southdown rams were introduced. A considerable number of rams of the Saidápet breed were distributed for breeding purposes in the Chingleput, Bellary and Tinnevelly Districts. The implement workshop on the estate was reopened this year, but so late that little work was done.

3. In the School of Agriculture thirty-four students were under training, of whom fifteen held stipends from Government and seven held stipends from the Native States of Travancore, Holkar and Wadhwan, and the Nariad Agricultural Association. Twelve were supported by their friends. Lectures were delivered on the usual subjects and gymnastic classes were maintained. The permanent buildings designed for the use of the school have made considerable progress.

4. Mr. Benson, Assistant Superintendent on the Farm, made an agricultural tour in Bellary. He was struck by the abundance and efficiency of the implements of cultivation in use. The Board note that the present report is rendered incomplete by the absence of any abstract of the tour report.

5. It was not considered desirable to hold any Agricultural Exhibitions so soon after the famine, and these were consequently pretermitted. On the other hand ploughing trials of an important nature were held in Bellary. Previous efforts of the same nature in Trichinopoly had been from one cause or another unsuccessful, and it was highly satisfactory to be able at length to convince the ryots of the superior efficacy of the European plough-share. From subsequent correspondence the Board think there can be little doubt that the impression made in Bellary is of a permanent nature.

6. The total expenditure on Government agricultural operations was Rs. 43,765, departmental receipts being Rs. 4,003. The excess was met from the half of the Surplus Pound Fund collections, amounting to Rs. 40,924, and from the Provincial grant of Rs. 20,000. The accounts show an accumulated balance of Rs. 2,60,274. The Superintendent should in future show comparative results for a term of years.

7. The Superintendent will observe that his report should in future go out in the form of Board's Proceedings. It can be submitted to the Board in print, but the copies should be proof copies.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

To the Secretary to Government, Revenue Department.
,, the Superintendent, Government Farms.
,, all Collectors.

READ—the following Proceedings of the Board of Revenue, dated 10th December 1881, No. 3182 :—

Read again Proceedings of the Board of Revenue, dated 12th November 1881, No. 9854, Miscellaneous.

Read the following letter from W. R. ROBERTSON, Esq., M.R.A.C., Superintendent of Government Farms, to the Secretary to the Board of Revenue, dated Saidápet 29th June 1881 :—

THIS report, refers to the Saidápet Farm only; a separate report will be submitted showing the work of the School of Agriculture, and another, in which the general operations of the department will be detailed.

Season.—On the whole the year was a favorable one. The total rainfall was 57·18 inches, registered on 95 days; the average of the previous ten years having been 52·75 inches, precipitated in 62 days.

3. The weather in April was, as usual, very dry, there having been only one slight shower in the month. Unfortunately there was no rain in May; though, in this month, the rainfall cannot be relied on here, the average monthly fall in the past ten years was 4·13 inches, but this average was made up largely by heavy cyclonic rains which, in some years, fall in this month. Rain is especially valuable in May, as it facilitates the preparation of the ground for the hot-weather crops.

Absence of May showers.

4. The fall in June was below the average, though there were more wet days than usual. These light showers were utilized, a considerable breadth of land having been ploughed, and sown with horse-gram, for fodder and green manure. In July the fall was slightly above the average; the rain was well distributed over the month in moderate showers. During August the amount of rain was slightly below the average; in the yearly part of the month it was too slight to admit of the proper performance of the tillages for the cold-weather crops that, at this time, are usually carried on.

5. In September there was twice as much rain as usual, but it fell chiefly in the early part of the month, and in heavy showers. On the 2nd, 3½ inches were registered, on the 10th the fall was nearly similar; while, two days afterwards, there was a further fall of 2 inches. The land became so saturated that tillage operations were stopped for some days, an unfortunate occurrence at this season of the year, when the whole available force of the farm should be uninterruptedly employed in preparing the soil for sowing, and in getting in the seed. The drought, during the latter half of the month, facilitated seed-sowing, but proved very injurious to the young crops then just appearing above ground; the maize crop suffered greatly. In October, there was nearly the average quantity of rain, but most of it fell in the latter half of the month.

6. The rainfall registered in November was about 7 inches above the average. On the 7th of the month, at about 3 in the morning, a heavy storm broke over the farm and neighbourhood, which did great damage; in three hours 4 inches of rain were registered.

Severe storm.

7. The early part of December was unusually wet, and the land being then saturated from the heavy rains in the latter part of the previous month, young crops suffered severely, while the more advanced crops flowering at the time were also damaged. The middle of the month was dry; there were several beneficial showers in the latter portion.

Crops suffered severely.

8. It is worthy of note that from the 31st October to the 3rd of December inclusive there were only 7 dry days, while the fall amounted to 23·86 inches.

Heavy rainfall.

9. A good shower fell in the middle of January, but, the ground being so dry, it produced no marked effect. This was the only rain that fell in the month; there was no rain in February or March.

10. The weather during January was unusually dull, cold and foggy; crops made but little progress, but there was a marked absence of fungoid diseases and of injurious insects. Cotton, however, suffered from "rust." In February the weather was much the same; early in the month the mango trees were heavily covered with blossom, but it was destroyed by the dense fogs which prevailed in the early mornings. A considerable breadth of paddy crop at the farm and in its neighbourhood, was attacked and much damaged by insects in this month. It was observed that the attacks were more severe on crops growing on low land on which the irrigation water accumulated. By running off the water and drying the land for a few days the damage was arrested and renewed vigor given to the plants. The foggy weather which characterized the two previous months continued up to about the middle of March, when the southerly winds began to blow and the atmosphere became clear and the temperature high.

Failure of Mango crop.

Injury to Paddy.

11. In the following statement the daily rainfall registration of the year are given; and, in Appendix I, statements of the monthly and weekly rainfall, compared with the averages of the past eleven years, during which the rainfall has been registered on the farm:—

Date.	1880.									1881.		
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.
1st ...	...	...	...	...	...	....	·45	1·17	2·20	...	...	...
2nd ...	...	...	...	·10	·05	3·50	...	1·22	·82	...	...	...
3rd ...	...	...	...	...	...	...	·03	·35	·35	...	...	...
4th ...	...	...	...	1·10	·08	...	...	·55	...	...	...	...
5th ...	...	...	...	...	...	...	...	...	·05	...	...	...
6th ...	...	...	...	...	...	·95	...	...	...	...	...	...
7th ...	...	...	...	·20	·10	...	...	3·85	·05	...	...	...
8th ...	...	...	...	·15	·53	...	...	...	...	...	...	...
9th ...	...	...	...	...	...	·26	...	·10	...	...	...	...
10th ...	·02	...	...	·09	...	3·45	..	1·30	...	...	...	...
11th ...	...	...	...	...	...	·52	·22	·50	...	..	...	...
12th ...	...	...	...	·08	·07	1·70		·80	...	·75	...	...
13th ...	...	...	·55	...	·10	·05	·12	·15	...	...	...	...
14th ...	...	...	·09	·16	...	·02	...	·10	...	...	...	...
15th ...	...	...	...	...	·02	...	·01	·05	...	...	...	...
16th ...	...	...	·25	...	1·24	...	...	·19	...	...	...	...
17th ...	...	...	...	...	...	...	·20	·34	...	...	...	...
18th ...	...	...	...	...	·44	...	·14	·15	...	...	...	...
19th ...	...	...	...	...	...	...	·35	...	...	...	...	...
20th ...	...	...	..	1·46	...	...	1·33	...	...	...	...	...
21st ...	...	...	·20	...	...	...	1·00	·95	·95	...	...	...
22nd ...	...	...	·02	...	...	...	·22	·75	·75	...	...	...
23rd ...	...	...	·30	·10	...	...	4·56	·42	...	...	...	...
24th ...	...	...	...	...	...	...	·66	·84	·16	...	...	...
25th ...	...	...	...	...	...	...	·25	...	·83	...	...	...
26th ...	...	...	...	..	·02	...	·31	...	·01	...	...	...
27th ...	...	...	...	·60	·12	....	·02	1·40	...	...	...	...
28th ...	...	...	·16	...	·18	...	...	2·10	...	...	...	...
29th ...	...	...	...	..	·12	·40	...	1·20	...	...	...	...
30th ...	...	...	·01	...	·05	·14	...	1·14	...	...	...	...
31st ...	...	...	...	·15	...	...	·87	...	...	...	...	...
Total ...	·02	...	1·58	4·19	3·12	10·99	10·74	19·62	6·17	·75	...	...

CROPS.

12. The total area under crop during the year was 121·94 acres; of this, 27·95 acres were under crop which stood throughout the year. Crops were raised on 33·51 acres for use as green manure.

13. *Fodder crops* were raised on an area of 36·65 acres, of which 6·28 acres were sown before the commencement of the year under report, and 1·21 acres were standing at the close of the year. Besides the crops recorded, 17·98 acres were under Guinea grass throughout the year, and this afforded pasture for the stock; besides this there were 4·23 acres of land planted with Hurriali grass, which also was pastured. The next statement shows the fodder crops harvested in the year, with particulars referring thereto :—

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.			Duration of Growth.	Rainfall.		Remarks.
				Date of.	Seed Sown.		Date.	Outturn.			Inches.	Wet Days.	
					Total.	Per Acre.		Fodder.	Per Acre.				
			ACRES.	D. M. Y.	LBS.	LBS.	D. M. Y.	LBS.	LBS.	DAYS.			
1	Yellow Cholum	4 V ...	·47	26 4 80	12	25·5	10 6 80	1,233	2,623	44	...	...	
2	Do.	4 VIII.	·29	13 4 80	40	137·2	12 6 80	1,456	5,021	60	...	...	
3	Do.	12 IV ...	·66	10 4 80	25	37·9	26 6 80	938	1,421	77	1·43	7	
4	Do.	20 ...	1·48	15 1 81	67·5	45·6	...	...	...	...	...	...	
5	Planter's Friend	4 VI ...	·43	25 14 80	20	46·5	10 6 80	408	949	45	...	...	
6	Do.	29 II ...	·79	4 9 80	50	63·3	12 11 80	2,018	1,696	69	28·07	35	
7	Cumboo and Horse-gram ...	13 ...	1·36	9 1 80	18·3	13·4	19 5 80	2,800	2,051	131	4·82	5	
8	Do.	15 I ...	4·17	6 7 80	75	17·9	26 8 80	13,296	3,188	52	5·64	19	
9	Do.	20 ...	1·48	23 6 80	50	33·7	31 8 80	2,523	1,705	69	7·78	28	
10	Do.	35 VI ...	·50	29 6 80	C. 11 / H.G. 20	22 / 40	27 8 80	2,583	5,166	59	7·15	24	
11	Cumboo and Yellow Cholum.	4 IV ...	·99	14 6 80	50	50·5	21 8 80	2,813	2,841	68	7·76	26	
12	Horse-gram and Planter's Friend.	27 II ...	2·05	31 8 80	80	39·0	23 11 80	6,639	3,239	84	34·67	45	
13	Horse-gram	34 I ...	1·38	26 6 80	32	23·2	30 8 80	1,740	1,261	65	7·48	27	Part of this crop was ploughed in.
14	Do.	34 II ...	·77	26 6 80	28	36·3	28 8 80	5,544	7,200	63	7·31	25	
15	Do.	19 ...	3·79	29 12 80	80	21·1	31 3 81	4,138	1,092	92	·75	1	
16	Do.	21 ...	3·07	8 2 81	40	13·0	27 5 81	2,735	890	108	·14	1	
17	Do.	12 IV ...	·66	7 7 80	25	37·9	15 9 80	3,759	5,695	70	16·72	30	
18	Guinea Grass	2 ...	1·62	...	...	...	13 11 80	1,983	1,224	...	...	...	One cutting only; field also grazed.
19	Do.	22 ...	4·66	...	...	...	...	15,201	3262	...	...	...	
20	Do.	16 ...	4·82	30 11 80	Planted.		4 3 81	3,611	749	94	8·06	12	First cutting.
21	Car Paddy	28 I ...	·50	24 12 80	100	200	12 4 81	1,464	2,928	109	·76	2	Irrigated; also thinned for seedlings.
22	Sumba Paddy (60 days) ...	28 III-C.	·51	4 12 80	Planted.		23 4 81	522	1,024	140	3·55	1	
23	Do.	28 II-A...	·20	27 12 80	30	150	22 4 81	731	3,655	116	·75	1	

Cereal fodder crops light.

14. The cereal fodder crops were light for such a good growing season, but the gram fodder crops were good. It will be observed that, with one exception, the whole of these crops are indigenous ones. Further experience confirms the opinion long ago expressed, that South India is remarkably rich in the possession of fodder crops suited to the different soils and the widely differing conditions of climate which characterise the cropping seasons. It is worthy of notice that, in so short a growing period as six weeks, fair crops of fodder were produced. The outturns per acre differ widely; this must be attributed chiefly to the great differences in the soils of the farm. As a rule, the better soils are reserved for other crops than fodder.

South India rich in fodder crops.

15. *Food-grain crops* were raised on about 40 acres of land. In addition to the ordinary indigenous crops, *Sorghum saccharatum*, *Sorghum Kaffrarium*, and Madagascar paddy were grown as field crops.

16. *Unirrigated cereals* occupied 13·62 acres of land; they were all raised during the cold season, the summer rains not having commenced sufficiently early to admit of cumboo being sown as a hot-weather grain crop. The following statement gives full particulars regarding these crops:—

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.		Remarks.
				Date of.	Seed Sown.		Date.	Outturn.					Inches.	Wet Days.	
					Total.	Per Acre.		Grain.	Straw.	Grain per Acre.	Straw per Acre.				
	Unirrigated Cereals.		ACRES.	D. M. Y.	LBS.	LBS.	D. M. Y.	LBS.	LBS.	LBS.	LBS.	DAYS.			
1	Ragi	1 ...	·595	2 10 80	28	47·0	27 1 81	408	1,197	686	2,012	117	36·84	50	
2	Maize	1 ...	·595	2 10 80	28·5	47·9	8 1 81	Cobs. 443 lbs.	418	745	703	98	36·08	49	
3	Sorghum saccharatum ...	3 ...	1·78	12 10 80	33	18·5	19 2 81	422	3,373	237	1,895	130	36·58	48	
4	White Cholum	8 ...	2·00	15 11 80	55	27·5	16 3 81	1,109	5,688	555	2,844	122	16·40	22	
5	Ragi	14 ...	2·31	5 10 80	45	19·5	22 1 81	1,729	2,352	748	1,018	109	36·80	49	Not threshed until May 31st.
6	Do.	33 ...	2·36	28 9 80	46	19·5	4 1 81	280 561	1,050 1,301	356	996	98	36·71	52	The second entry of receipt refers to part of the crop stacked and threshed on May 21st.
7	Planter's Friend	18 ...	3·06	16 9 80	101	33	22 1 81	2,910	16,782	951	5,484	128	37·46	53	
8	Yellow Cholum	34 I ...	·92	15 9 80	30	32·6	31 12 80	605	5,096	658	5,539	107	36·71	52	

17. It will be seen that, excluding crop No. 2, which was harvested in the cob, there were 13·02 acres under crop which yielded an average of 599 lbs. of grain and 2,827 lbs. of straw per acre. The *Sorghum saccharatum* was a poor crop, and this brought down considerably the average outturn per acre: this crop does not thrive well when the weather is unusually wet, and the temperature low. On the other hand the Planter's Friend, which is closely allied to the *Sorghum saccharatum*, did remarkably well. Further experience with this crop has shown that it is a hardy one, and capable of withstanding adverse conditions that would prove disastrous to a crop of *Sorghum saccharatum*.

Planter's Friend a hardy crop.

18. *Irrigated Cereal Food crops* were raised on an area of 16·63 acres of land irrigable from the Mylapore tank. On most of the land two crops were raised, the latter ones being watered in the later stages of their growth, by baling, the tank water not then being available at a sufficient height to admit of it flowing on the land. For some of these second crops sufficient water could not be got, and the outturn from them was accordingly considerably lessened. The total area of crop raised to maturity was 26·82 acres, the particulars of which are shown in the following statement:—

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing. Date of.	Sowing. Seed Sown. Total.	Sowing. Seed Sown. Per Acre.	Details of Harvesting. Date.	Outturn. Grain.	Outturn. Straw.	Outturn. Grain per Acre.	Outturn. Straw per Acre.	Duration of Growth.	Rainfall. Inches.	Rainfall. Wet Days.	Remarks.
	Irrigated Cereals.		ACRES.	D. M. Y.	LBS.	LBS.	D. M. Y.	LBS.	LBS.	LBS.	LBS.	DAYS.			
9	Madagascar Paddy	29 I ...	1·04	20 9 80	48	46·1	10 2 81	1,483	2,436	1,426	2,342	143	37·46	53	Has been followed by horse-gram.
10	Do.	35 I ...	·31	15 9 80	20	64·5	20 1 81	280	896	903	2,890	127	36·71	52	Followed by No. 51.
11	Seroomoney Paddy ...	30 I*a* ...	1·8	28 8 80	75	41·7	19 2 81	2,912	8,430	1,618	4,683	175	48·62	64	Do. by No. 50.
12	Sumba Paddy (60 days) ...	29 II ...	·74	20 9 80	80	108·1	7 12 80	866	1,932	1,170	2,611	78	34·01	47	Do. by No. 31.
13	Do.	28 III*a* ...	·24	2 11 80	100	417	27 1 81	226	763	942	3,179	86	24·15	32	
14	Do.	35 II ...	·61	14 9 80	40	65·6	4 12 80	450	902	738	1,479	81	34·27	45	Do. by No. 32.
15	Do.	35 IV ...	·35	11 9 80	25	71·4	4 12 80	184	483	526	1,380	84	36·04	47	Do. by No. 33.
16	Do.	36 II ...	·46	10 9 80	5	10·0	3 12 80	134	266	291	578	84	36·56	48	Do. by No. 34.
17	Do.	36 III ...	·90	11 9 80	100	111·1	3 12 80	682	1,302	758	1,447	83	36·04	47	Do. by No. 35.
18	Do.	37 II ...	·82	7 10 80	Planted.		17 12 80	861	1,945	1,050	2,372	71	33·35	42	Do. by No. 37.
19	Do.	37 III ...	·46	7 10 80	Do.		15 12 80	602	1,382	1,309	3,004	69	33·35	42	Do. by No. 38.
20	Do.	37 IV ...	·52	6 10 80	Do.		11 12 80	630	1,152	1,212	2,215	66	33·35	42	Do. by No. 39.
21	Do.	37 V ...	·67	6 10 80	Do.		11 12 80	521	980	778	1,463	66	33·35	48	Do. by No. 40.
22	Car Paddy	37 I ...	·45	17 10 80	Do.		3 1 81	652	1,700	1,449	3,778	78	35·50	43	Do. by No. 36.
23	Do.	36 I ...	1·58	15 9 80	100	63·3	31 12 80	1,070	2,408	677	1,524	107	37·07	51	
24	Do.	35 III ...	·57	14 9 80	40	70·2	31 12 80	478	996	839	1,747	108	35·71	45	Do. by No. 46.
25	Do.	30 II*a* ...	·66	23 9 80	60	90·9	7 1 81	704	1,218	1,067	1,845	106	36·71	52	
26	Do.	28 I ...	·28	6 11 80	Planted.		22 1 81	261	458	932	1,636	77	23·25	30	
27	Manacuthy Paddy	30 II*b* ...	1·33	22 9 80	123·5	92·8	5 1 81	1,262	2,192	949	1,648	105	36·71	52	Do. by No. 47.
28	Do. ...	28 I ...	·31	8 11 80	Planted.		2 2 81	108	256	348	826	86	19·40	29	
29	Goondoo Sumba Paddy. ...	35 V ...	·79	11 9 80	45·5	57·6	19 2 81	1,446	3,892	1,830	4,927	161	39·59	55	
30	Car Paddy	28 II ...	·40	4 12 80	40	100·0	6 4 81	172	934	430	2,335	123	3·55	8	
				Planted.	Bundles.										
31	Do.	29 IV ...	·74	17 12 80	274	370·3	31 3 81	1,225	2,587	1,655	3,496	104	3·45	6	
32	Do.	35 II ...	·61	13 12 80	550	901·6	7 4 81	624	1,692	1,023	2,774	115	3·45	6	
33	Do.	35 IV ...	·35	14 12 80	250	714·3	31 3 81	349	541	997	1,546	107	3·45	6	
34	Do.	36 II ...	·46	15 12 80	300	652	31 3 81	632	1,338	1,374	2,909	106	3·45	6	
35	Do.	36 III ...	·90	16 12 80	650	620·2	23 4 81	1,006	2,650	1,118	2,944	128	3·45	6	
36	Do.	37 I ...	·45	11 1 81	320	711	23 4 81	370	1,326	822	2,947	102	·75	1	
37	Do.	37 II ...	·82	3 1 81	650	792·7	23 4 81	612	1,616	746	1,971	110	·75	1	

No.	Description of Crop.	Number of Field and Plot.	Area of Plot.	Sowing.			Details of Harvesting.					Duration of Growth.	Rainfall.		Remarks.
				Date of.	Seed Sown. Total.	Seed Sown. Per Acre.	Date.	Outturn. Grain.	Outturn. Straw.	Grain per Acre.	Straw per Acre.		Inches.	Wet Days.	
	Irrigated Cereals—(Contd.)		ACRES.	D. M. Y. Planted.	Bundles.		D. M. Y.	LBS.	LBS.	LBS.	LBS.	DAYS.			
38	Car Paddy	37 III ...	·46	22 12 80	500	961·5	21 4 81	870	1,736	1,891	3,774	120	1·75	4	
39	Do.	37 IV ...	·52	21 12 80	450	865·4	23 4 81	945	1,823	1,817	3,505	122	2·50	5	
40	Do.	37 V ...	·67	18 12 80	420	626·9	20 4 81	1,028	2,350	1,534	3,507	123	3·45	6	
					Seed. lbs.	lbs.									
41	Do.	28 I, b & m.	·37	17 11 80	40·5	109·5	6 4 81	532	1,141	1,438	3,084	140	15·87	20	
42	Do.	28 I ...	·24	24 12 80	30	125	28 4 81	165	1,665	688	6,938	125	1·75	3	
43	White Car Paddy ...	28 I*n* ...	·16	15 11 80	24	150	6 4 81	209	603	1,306	3,769	142	16·40	22	
44	Sumba Paddy (60 days) ...	35 III ...	·57	31 12 80	40	70·2	31 3 81	423	1,122	742	1,968	90	·75	1	
45	Do.	30 II ...	1·33	15 1 81	150	112·8	23 4 81	736	4,370	553	3,286	98	...	...	
46	Madagascar Paddy ...	34 II*a* ...	·19	31 12 80	15	79·0	14 5 81	64	366	337	1,926	134	·75	1	
47	Do.	34 II*b* ...	·19	31 12 80	15	79·0	14 5 81	60	362	316	1,905	134	·75	1	
48	Carolina Paddy	34 II*c* ...	·19	2 12 80	Planted.		31 3 81	22 *50	60 210	382	1,421	119	4·72	10	*Sample much mixed. Second entry Car Paddy picked out.
49	Sumba Paddy	28 II-6 ...	·20	27 12 80	Do.		6 4 81	172	321	860	1,605	100	·75	1	
				Planted.	Bundles.										
50	Ragi	30 I*a* ...	1·80	5 3 81	1,200	667	18 5 81	361	2,108	200	1,171	74	...	...	
51	Do.	35 I ...	·31	2 3 81	210	677·4	21 5 81	78	157	251	506	80	...	...	

19. It will be seen that 26,517 lbs. of grain and 67,067 lbs. of straw were in a period of 7 months produced on 16·63 acres; the average outturn per acre being thus grain, 1,594 lbs. and straw 4,033 lbs. As has already been noticed, much of this crop was second crop, which, from unavoidable circumstances, did not receive as good treatment as was desirable. Field 34 II, on which the Carolina paddy and Madagascar paddy were sown, was but recently levelled, much of the poor subsoil being exposed, hence the partial failure of these crops in this field.

20. *Industrial Crops.*—Of these crops the produce of 31·87 acres was harvested in the year; of this 23·66 acres were standing at the commencement of the year. At the close of the year there were 20·81 acres under these crops that were sown during the year, and the produce of which will not be harvested until next year; these were—

	ACRES.
Cotton	10·22
Indigo	8·08
Oil-seeds	1·19
Sugar-cane	1·32
Total ...	20·81

Casuarina trees for fuel, and to afford protection for fruit trees, to be afterwards planted, were planted out on 5·63 acres of poor land. Industrial and miscellaneous crops occupied 36·12 acres as below:—

Number.	Description of Crops.	Number of Field and Plot.	Area of Plot.	Sowing. Date of.	Sowing. Seed Sown. Total.	Sowing. Seed Sown. Per Acre.	Details of Harvesting. Date.	Details of Harvesting. Outturn. Gross.	Details of Harvesting. Outturn. Per Acre.	Duration of Growth.	Rainfall. Inches.	Rainfall. Wet Days.
			ACS.	D. M. Y.	LBS.	LBS.	D. M. Y.	Number of Canes.		Days.		
1	Sugar-cane ...	12 I ...	·82	21 12 79	.	...	26 11 80	8,738 ...	10,656 ...	340	52·07	85
								Seed cotton, lbs.				
2	Cotton ...	11 ...	2·96	22 8 79	30	10·1	31 7 80	1073·5 ...	363 ...	343	52·52	69
3	Do. ...	32 ...	4·76	3 9 79	45	9·4	6 8 80	689·5 ...	145 ...	334	48·43	64
4	Do. ...	1 ...	2·38	1 9 79	24	10·0	13 8 80	365·75 ...	157 ...	346	49·17	67
5	Do. ...	27 II ...	2·05	26 8 79	20	9·7	24 8 80	403·00 ...	197 ...	363	54·93	76
6	Do. ...	16 ...	4·82	6 9 79	12	2·4	27 8 80	765·25 ...	159 ...	355	51·07	71
							Last cutting.	Seed. Bundles. lbs. No.	Seed. Bundles. lbs. No.			
7	Indigo ...	3 ...	1·78	21 1 80	43	24·1	5 10 80	... 216	... 121	257	25·18	50
8	Do. ...	36 II & III.	1·36	23 3 80	15	9·5	19 8 80	185 ...	136 ...	149	8·42	29
9	Do. ...	37 I ...	·62	16 4 80	20	32·2	22 7 80	... 8	... 13	97	4·94	17
10	Do. ...	37 II ...	·45	25 3 80	12	26·6	22 7 80	... 27	... 60	119	4·94	17
11	Do. ...	37 III..	·50	1 4 80	12	24·0	22 7 80	... 12·5	... 25	112	4·94	17
12	Do. ...	32 ...	4·76	30 8 80	50	10·0	20 1 81	... 141·5	... 30	143	51·04	66
13	Do. ...	11 ...	1·88	30 8 80	104	55·3	19 2 81	205·5 12	109 6	173	48·27	60
14	Castor Beans.	13 ...	2·73	22 11 79	32·5	11·9	Up to 22 11 80	1,248 ...	457 ...	365	53·22	89
	Miscellaneous Crops.											
								Bunches.	Bunches.			
1	Plantains ...	4-B I ...	·93	15 3 78	...	...	During the year.	293 ...	315 ...	365	57·16	94
2	Do. ...	4-B II..	1·25	6 6 79	...	...						
3	Tapioca	4-B III.	·80	18 8 80	...	...		Will shortly be available.				
4	Plantains			30 11 80	...	...						
								Bunches.				
5	Do. ...	12 II ...	·87	19 9 76	...	...	During the year.	157 ...	180 ...	365	57·16	94
6	Do. ...	12 III ..	·85	26 12 78	...	...	Do.	227 ...	267 ...	365	57·16	94
7	Arrowroot ...	4-A II..	·25	20 10 79	...	...	29 1 81	986 ...	3,944 ...	466	98·49	33
8	Bendacoys ...	4-A III.	·10	2 10 80	7	70	21 12 80	68 ...	680 ...	80	45·77	56

21. *Sugar-cane.*—The plot occupied by this crop at the beginning of the year, referred to in paragraph 60 of the last report, was planted with cane on the 21st

December 1879. The land had previously carried plantains, and during their growth had been brought into a fair condition. The soil however, like the soils of the farm generally, is naturally poor. The land can be watered from a well close by, which contains a good supply of water about 20 feet below the surface. The plantains were removed in June 1879, and the land ploughed and harrowed frequently during the ensuing months. On December 9th 18 cwts. of powdered bones were applied broadcast to the plot; these were ploughed in just before trenching for planting. One-half of the plot was trenched 3 feet apart, and the other 6 feet, and the canes were planted in the bottom of the trenches after watering. After planting, the land was occasionally watered to sprout the canes, and ashes were applied to check the ravages of the white-ants. The canes sprouted fairly, although a good many blanks were caused by the white-ants; and the crop continued healthy and to make good progress until the middle of March, when 3 tons of poudrette was applied. The progress of the crop, except on a portion of the part planted in rows 6 feet apart, which never did well, continued to be good. At the end of April, 23 loads of slaughter-house refuse was applied. A few rows (four) of the closely planted crop, received a further application of manure at the end of May, and the crop continued to progress fairly until the middle of June, when it received a check, but soon recovered and continued healthy throughout the remainder of its growth. In August (1,270) canes were taken out for use as seed-cane in another field of the farm, and again in November 304 canes were removed for the same purpose. By the end of December last the canes were fit to cut. Some of the canes were sold standing; a row 80 yards long being sold for Rs. 2-4-0, or at the rate of Rs. 136-2-0 per acre. During January and the early part of February the whole crop was removed and the greater part crushed in one of Thomson and Mylne's Beheea Sugar-mills, and the juice boiled down into jaggery. Canes weighing 12,383 lbs. were crushed and the juice boiled down into jaggery, and yielded 780¼ lbs., which sold for Rs. 46-9-0. The yield of jaggery from an average row of canes was about 34 lbs., worth Rs. 2-0-4. The total outturn of canes was not recorded, but in the following table some results obtained from part of the different plots are given.

Yield of jaggery.

Plot planted.	Number of Rows.	Area.	Weight of Canes crushed.	Weight per Acre of Canes.	Jaggery made.	Jaggery per Acre made.	Jaggery per 100 lbs. of Canes.
		SQ. YDS.	LBS.	LBS.	LBS.	LBS.	LBS.
3 feet apart ...	16	1,280	7,642	28,896	485¾	1,836·7	6·36
6 „ „ ...	8	1,280	4,741	8,555	294½	1,113·5	6·2

22. These results show that it is more profitable here to sell the canes standing for retail sale in the bazaar, and that, on soil of the nature of that in the field where this crop was raised, the crop does better in every way if planted in rows only 3 feet and not 6 feet apart.

More profitable to sell canes than make jaggery. Wide planting not successful.

23. At the time of crushing the cane an experiment was made to compare its sugar-producing quality with that of cane raised in the neighbourhood, for which purpose some canes were purchased. The results were as follow:—

—	Weight crushed.	Juice extracted.	Percentage of Juice extracted.	Jaggery produced.	Jaggery to 100 lbs. of Cane.	Jaggery made from 100 lbs. Juice.	Remarks.
	LBS.	LBS.		LBS.	LBS.	LBS.	
Purchased Canes.	59	31	52·5	3	5·1	9·7	The farm canes only averaged 4 feet in length, whilst those purchased averaged 5½ feet in length.
Farm-grown Canes ...	40·75	26·25	64·4	3½	8·6	13·3	

24. There is nothing to show how the purchased canes had been treated during their growth, but the results are satisfactory, especially when the poverty of the farm-soil is considered. The proportion of jaggery obtained in this case was higher than the general average with farm-grown canes, but this may have been due to several causes, more efficient extraction, less concentration, &c.

Farm cane rich in sugar.

25. At the time the crushing referred to was going on, an experiment was made to test the sugar-producing qualities of Planter's Friend and Sorghum stalks. Unfortunately no perfectly fresh stalks of Planter's Friend were available at the time, and it is probable that all the sugar of the sample experimented with was not extracted. The following are the results of an examination made by Mr. Hamilton, Chemical Lecturer in the School of Agriculture, of the juices expressed; the juice of some ordinary sugar-cane having also been tested at the same time;—

Plant extracted from.	Specific Gravity.	Crystallizable Sugar.	Uncrystallizable Sugar.
		Per cent.	Per cent.
Sugar-cane	1065	15·07	8·42
Sorghum	1061	9·03	5·68
Planter's Friend	1064	5·101	3·83

26. These results, as far as they go, show that both the Sorghum and Planter's Friend cultivated here are rich in sugar, but it will be necessary to devote attention to the best time for cutting, for crushing, and also the treatment of the juice afterwards. The large amount of uncrystallizable sugar in the juices may have been partly due to the time at which the crops were cut, and also to their being stored.

Special experiments needed in the culture of Sugar Sorghums.

27. Regarding *Sorghum saccharatum* Mr. Hamilton afforded the following information: "The stems of some Sorghum plants with the seeds ripening, were "cut into segments and split, and 2 lbs. of the stems so prepared, were put into "a clean screw-press. Eleven ounces of juice were expressed, beautifully clear, "and having a fine olive-green color." This juice gave the following results:—

Specific gravity	10·59
Crystallizable sugar	10·32 per cent.
Uncrystallizable sugar	1·79 do.

These results, owing to the care in expressing the juice, the freshness of the sample, and the avoidance of delay in determining the sugar, are more reliable than those before given.

28. In crushing, by means of the mill before referred to, 100 stalks of each crop, and making the juice into jaggery, the following results were obtained:—

Plant.	Weight of Cane crushed.	Weight of Juice extracted.	Percentage of Juice extracted.	Jaggery made.	Jaggery made for 100 lbs. Canes	Jaggery made for 100 lbs. Juice.
	LBS.	LBS.		LBS.	LBS.	LBS.
Planter's Friend	24	10·75	44·8	1·25	5·2	11·6
Sorghum	29·5	10·50	35·6	1·375	4·7	13·1

29. The stalks were stripped before being crushed, and, compared with the yield obtained in America, the percentage of juice is low, but it should be remembered that the canes were not in the best state for crushing. It is believed also that in stripping the canes there is a loss of juice. If further experience shows that the removal of the stem leaves when clean is unnecessary, as there is reason to

believe, there will be a considerable saving in the cost of making jaggery, as stripping the canes is costly.

30. The *Cotton crops* of the season 1879-80, referred to in paragraph 51 of the last report, gave the results mentioned in the table below :—

Months.	Field No. 1.			Field No. 11.			Field No. 16.			Field No. 27.			Field No. 32.			Total.			
	Cotton in Seed.	Lint.	Percentage.	Cotton in Seed.	Lint.	Percentage.	Cotton in Seed.	Lint.	Percentage.	Cotton in Seed.	Lint.	Percentage.	Cotton in Seed.	Lint.	Percentage.	Cotton in Seed.	Lint.	Percentage of Lint.	Percentage of Total Crop in Month.
	LBS.	LBS.		LBS.	LBS.		LBS.	LBS.		LBS.	LBS.		LBS.	LBS.		LBS.	LBS.		
January ...	29¾	9½	31·9	33¼	10	30·0	121¼	32¾	27·0	11¼	3¾	33·3	6¾	2	29·6	202½	58	28·7	4·68
February ...	...	...	...	77¾	24	30·9	31	10	32·2	...	...	...	...	...	...	108¾	34	31·3	2·71
March	137	43½	31·7	211	65	30·8	111	36	32·4	140½	42	29·9	257¾	86	33·3	857¼	272½	31·8	21·80
April	334	106	31·0	130	42	32·3	148	47	31·7	87½	26	29·8	61½	19	30·9	761	240	31·5	19·20
May	349¾	115	32·8	407¾	131¼	32·1	227	74½	32·8	68¾	21	30·6	132	42	31·8	1,185	383¾	32·4	30·71
June	166¼	50	30·0	160	48	30·0	127	38	29·9	33¾	10	29·6	136	42	30·9	623	188	30·2	15·12
July	56	15	26·7	53¾	14	26·0	...	...	...	61½	17½	29·2	95½	26½	27·7	266¾	73	27·4	5·83
August... ...																			
Total ...	1,072¾	339	...	1,073½	334¼	...	765¼	238¼	...	403	120¼	...	689½	217½	...	4,004	1,249¼	...	100·00
Average per Acre.	450·7	142·9	31·6	362·7	112·9	31·1	158·8	49·4	31·1	158	47·2	30·5	144·8	45·7	31·5	229·2	71·9	31·2	...

31. Taking the results generally, the yield was rather low, but that may be chiefly explained by the poverty of several of the fields, particularly Nos. 16 and 27. The yield of lint was satisfactory, the largest proportion being obtained in May during the driest weather; when the cotton is picked in the driest state. The crop began to bear late in the season, the greatest produce was obtained during the three months of March, April and May. The results here recorded, taken in conjunction with those obtained in previous years, point decidedly to the advisability of removing cotton at the end of June, and also of sowing the crop as early in August as may be practicable.

Advisable to sow crop early in August.

32. The crop in No. 1 field followed cotton on the eastern and poorer portion of the field, and sugar-cane on the western; it was sown on September 1st in alternate ridges with Planter's Friend. The seed germinated well and the plants grew vigorously, whilst the crop of Planter's Friend was a very fine one. Throughout the year the plants were in a flourishing condition. The value and the cost of producing the cotton and Planter's Friend crops are shown in a table at paragraph 37.

33. In No. 11 field the crop followed indigo, the soil being a sandy loam in good manurial condition. It was grown on the ridge system in alternate lines with yellow cholum, being sown at the end of August. It grew well on the whole area, and the plants attained a considerable height. The cost and value of these crops are also shown below.

34. The crop raised in No. 16 field is referred to in paragraph 35 of the report for 1879-80, where it is stated that the crop had suffered greatly during the early stages of its growth. This field was before preparation for sowing, divided into two portions, and one-half was manured with box-manure broadcasted and then ploughed in before ridging, whilst the other half was manured in the ordinary way by spreading the manure between the ridges and then splitting the soil over it. The cotton crop was, during a considerable portion of the year, collected from each part of the field separately, with the following results :—

Collected from	Broadcast portion, Area 2·41.		Ridged portion, Area 2·41.	
December to March ...	Gathered together. Cotton in seed = 176 lbs.; yielded 57¾ lbs. lint.			
———	Cotton in Seed.	Yield of Lint.	Cotton in Seed.	Yield of Lint.
March to June	LBS. 322½	LBS. 96	LBS. 255	LBS. 80½

35. The soil of field No. 27 is of most uneven character; in some places it is a clay and extremely cohesive, in others sandy or a sandy loam. The crop of cotton, with one of Planter's Friend grown on the ridge system in alternate lines with it, was the first that has given a satisfactory return, and, considering the nature of the land, is fair. The financial results are shown further on.

36. In No. 32 field the soil is a sandy loam, well drained and in fair condition. The crop, which followed horse-gram preceded by white cholum, was sown at the beginning of September on ridges in alternate lines with black cholum; it grew well at first, but received a check during the dry weather at the end of the month and never recovered. The low yield may be partly attributed to the fact that a portion of the field was sown with new unacclimatised Upland cotton, which crop did very badly.

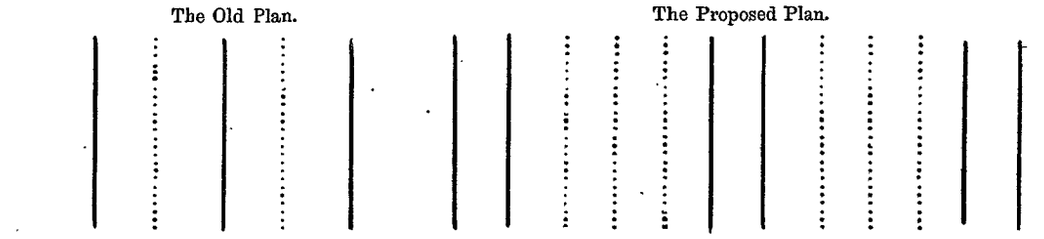
37. In the table below the cost of growing and the value of the produce received from each of these crops is shown;—

Description of Crop.	Number of Field and Plot.	Value of unexhausted Manure brought forward.	Cost of Preparation of Land.	Cost of Seed and Sowing.	Cost of after-cultivation.	Cost of Harvesting and securing Produce.
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
N. O. Cotton and Planter's Friend	1 ...	36 15 0	18 6 0	3 12 0	21 15 0	8 13 0
Do. and Yellow Cholum.	11 ...	18 12 9	18 2 0	6 4 0	27 11 0	13 11 0
Do. and Maize	16 ...	...	50 4 0	7 6 0	20 11 0	7 11 0
Do. and Planter's Friend.	27-B ...	...	12 12 0	3 7 0	15 4 0	3 4 0
Do. and Black Cholum...	32 ...	...	18 1 0	8 15 0	41 3 0	7 2 0

Description of Crop.	Number of Field and Plot.	Value of Manure applied.	Total Expenditure on Crop.	Value of unexhausted Manure carried forward.	Net Cost of Crop.	Value of Produce.
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
N. O. Cotton and Planter's Friend	1 ...	19 6 0	109 3 0	28 2 0	81 1 0	120 4 2
Do. and Yellow Cholum.	11 ...	22 8 0	107 0 9	20 10 0	86 6 9	199 4 5
Do. and Maize	16 ...	55 8 0	141 8 0	27 12 0	113 12 0	80 0 10
Do. and Planter's Friend.	27-B ...	55 2 9	89 13 9	27 13 0	62 0 9	81 10 2
Do. and Black Cholum...	32 ...	44 0 0	119 5 0	22 0 0	97 5 0	223 4 2

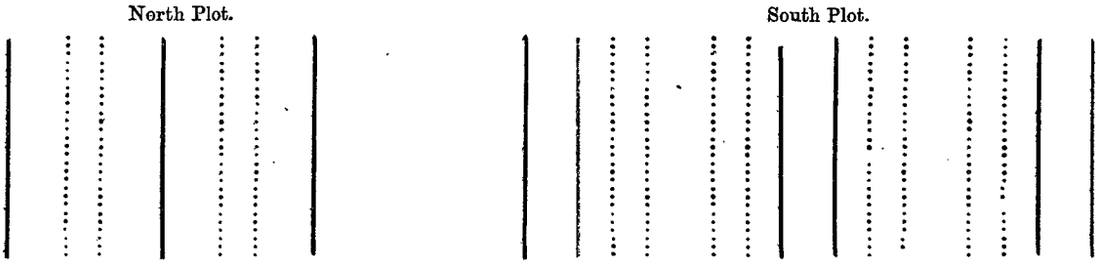
38. In field No. 18 an experiment in altering the arrangement heretofore adopted for sowing cotton was made during the current season. It has been usual to sow cotton on ridges regularly in alternate lines with a cereal—maize, cholum, &c.; but it appeared likely to be more convenient if the cotton plants were grown more closely together, but with greater intervals between the rows; thus in the diagram

below, the dotted lines indicate the rows of the cereal crop and the plain ones the cotton plants:—



The distance in the old plan between the rows of cotton being 4 feet, and in the proposed alternately 2 feet and 6 feet, so that the same number of rows would be sown on either system in a given area. The presumed advantages in favor of the new system were, that it would render the work of keeping the cotton-field clean, after the removal of the cereal, cheaper and more easy, and that both the cotton and the cereal would thrive better.

39. No. 18 field was manured heavily last June with village sweepings, at the rate of about 50 loads per acre; the manure was of poor quality, but not costly. Horse-gram was then sown, which was ploughed in green at the end of August, the crop being a small one. The field was then prepared for sowing, and cotton and Planter's Friend were sown on September 16th on the flat in two plots on the system shown below, the lines being used to designate the different crops as has been done above:—



40. In the north plot the lines of cotton were regularly 4 feet apart, with a double row of Planter's Friend between each; the two rows of the cereal being 5 inches apart. In the south plot the lines of cotton were alternately $5\frac{3}{4}$ feet and 2 feet apart, and the cereal in two double rows between the double rows of cotton with a space of 33 inches between them. It will be noticed that there is a slight variation from the proposals before sketched; that regarding the position of the cotton rows, was made for convenience in sowing, our seed-drill being 5 feet 9 inches wide, and that regarding the cereal, from an error on the part of the officer in charge of the farm at the time; the variations, however, cannot materially affect the results.

41. The outturn from the Planter's Friend only has as yet been recorded; that from the cotton cannot be given till next year. The results from the Planter's Friend were as follows:—

—	Area in Acres.	Outturn of		Outturn per Acre.	
		Straw.	Grain.	Straw.	Grain.
North side	1·12	56·98	894	5,087	798
South side	1·12	36·92	514	3,296	459

42. It is scarcely possible that the different systems of sowing can have caused the whole of the great variation in the outturn from the cereal crop. The north

side of the field is better drained, and in the southern plot there is a large mango tree, which interferes considerably with the growth of the crops near it, especially with cereals. The crop on the two plots was harvested in different manners; that from the northern plot was reaped bodily on January 15th, and the ears were cut off afterwards in the yard; from the southern plot the ears were first cut off and the straw was reaped on January 20th. These facts, and the possibility of the straw of the two plots having been in different degrees of dryness when weighed, may to some extent account for the difference of yield.

43. In No. 10-A a similar experiment was commenced; cotton having been sown in the same way as denoted above in two parts of the eastern side of the field with maize between the rows; the maize crop was a failure, and the results of the cotton crop cannot be given until next year. All the other cotton crops of the year were sown on the flat in double lines 2 feet apart, with two double rows of cereal between them; and judging from the results, so far the system is much cheaper and more convenient than that of sowing cotton in single alternate lines with a cereal on ridges.

Improved method of cotton culture.

44. Of the *Indigo crop* harvested in 1880, that grown in No. 3 field will be referred to under head "Rotations." The remaining crops were not of much importance; they were all catch-crops, grown on the land irrigated from the Mylapore tank after harvesting, the paddy crop being sown at various dates from April 23rd to May 25th. These crops were not successful, but it must be remembered that they were not regular crops. Those grown in fields No. 36 II and III and No. 37 II and III yielded fairly; that raised in No. 36 was a seed crop. Of the crops sown during the season of 1880-81, only one appears in the table and is that raised for seed in No. 11 field. It was sown on August 30th in rows alternately 6 inches and 18 inches apart, but germinated unevenly over the surface, probably partly owing to the excessive rainfall on September 2nd; and, although the blanks were resown, it was not considered advisable to retain the whole crop, so a portion on the poorer part of the field was taken out and the remainder retained for seed, of which 182½ lbs. were obtained. The results obtained from the remaining fields sown with indigo this year will be dealt with in the next report.

45. The *Oil-seed crop*, referred to at paragraph 53 of the last report, grew very well throughout the year, and was not removed until January last. The field, which measures 2·73 acres, was sown with several varieties raised from some castor beans obtained from Italy, and the results in several cases were very good. A full record is not available, but the general results were as follow:—

Plot	1	2	3	4	5	6
Area in Acres	·57	·57	·42	·41	·41	·25
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.
Seed sown	7	6	4	2·5	2	1
Seed per Acre	12·5	10·5	9·5	6	5	4
Yield	161	489	125	260	195	18
Yield per Acre	282	858	293	634	475	72

The outturn from the last plots was affected by the inferiority of the soil of the field where they were situated.

46. The season was not a favorable one for the growth of oil-seeds. No summer crops of gingelly were raised, and the only cold weather one sown did not succeed. A crop of castor beans, occupying one acre, was standing at the end of the year and the results will be given hereafter.

Season not a good one for oil-seeds.

47. *Plantains.*—Regarding the plantains there is nothing worthy of remark, except as regards crop No. 4 in the statement, which was planted between rows of tapioca (*Janipha manihot*) plants purposely put in to afford shade, and to occupy the ground during the first portion of the growth of the plantains. Owing, however, to the tapioca having been planted too closely together, the plantains have made

very little progress. The Manilla hemp (*Musa textilis*) plants referred to in paragraph 66 of the last report as having been put down amongst the plantains in No. 4 field, continue to grow well in that position, and although none have yet reached that stage of maturity when it is advisable to prepare fibre from them, some are already very fine trees.

Manilla hemp plants growing well.

48. *Arrowroot* (*Curcuma augustifolia*).—A plot measuring ·25 acres was planted with this crop at the end of 1879, and remained down during the year under report. It was taken up at the end of January last and yielded 986 lbs. of tubers, or at the rate of 3,944 lbs. per acre. The yield of flour obtained has generally been about 12½ lbs. from 100 lbs. of tubers, so that the above yield would represent an outturn of 493 lbs. of flour per acre. In another case in the College Experimental Garden, a plot measuring 1,160 square yards planted with this crop yielded 1,798 lbs., or at the rate of 7,500 lbs. per acre. The culture of this crop is very simple: it is only necessary to plant the sets in properly-prepared soil, and to water them occasionally during the dry season. The removal of the crop is tedious unless the tubers can be ploughed out, as potatoes are done in England, which is seldom possible owing to the dryness of the soil, so that the tubers have to be dug up. The preparation of the flour is also very simple and easy. The tubers have only to be reduced to pulp on a grater, after being well washed to remove soil and dirt, and then the pulp is mixed thoroughly with water so as to separate the starch completely from the fibrous matters. The whole is afterwards strained through cloth, through which the starch and water passes, and the fibre left behind. After this the starch has only to be thoroughly washed by decantation with clean water, and dried in the sun. It is then rolled on a table to break it up thoroughly into fine flour and is ready for sale. The flour can be produced at a very low price; it could be sold profitably at 4 annas per pound.

Arrowroot, yield of.

Arrowroot flour preparation.

49. *Tobacco*.—As mentioned in paragraph 59 of last year's report, samples of the leaf grown in the Botanical Gardens under experimental treatment as regards manure, and of that grown in No. 4 field, were submitted for chemical analysis; the results were as shown in the table below.

No.	Growth and treatment.	Analysis.		
		Percentage of Ash.	Percentage of Carbonate of Potash in Ash.	Percentage of Nicotine.
1	Grown in Botanical Garden, manured with horse manure at the rate of 20 tons per acre, occasionally irrigated and cured after American fashion	20·5	4·916	1·57
2	Grown in Botanical Garden, manured with lime at the rate of 8 tons per acre, cured like No. 1	19·40	3·323	1·62
3	Grown in Botanical Garden, manured with bone-charcoal at the rate of 6 tons per acre, cured like No. 1.	22·85	4·938	4·08
4	Grown in Botanical Garden, manured with ashes at the rate of 21 tons per acre, cured like No. 1	21·60	3·083	2·26
5	Grown in field No. 4, raised without manure and irrigation, cured like No. 1	19·65	3·395	2·31
6	Grown in field No. 4; grown without manure and without irrigation, cured according to country fashion	20·60	3·802	1·94
7	Tobacco, 20 plants raised in field No. 4 without manure and without irrigation, cured according to American fashion by simply hanging the same on sticks to dry, but not stripped as yet, therefore not completely cured	24·00	4·169	1·5
8	Grown in field No. 8, previous year, cured like No. 1...	21·75	3·433	2·04
9	Grown in field No. 8, previous year, cured like No. 1, but afterwards steeped in diluted H.Cl and jaggery water at the rate of 8 oz. of H.Cl and 1¼ viss of jaggery per 100 lbs. of tobacco	22·85	4·808	3·12

50. These results afford a great contrast to those obtained from the analysis of the tobacco raised on the farm, reported in 1872, when the percentage of carbonate of potash in the ash, was found to be only ·6 in one and ·67 in another case, and show how much the farm soils have been improved by careful cultivation. But still, notwithstanding this improvement, the figures given show that on our soils it will be almost impossible to raise tobacco fit for the European market profitably. On the proportion of organic salts of potash in the leaf the "whiteness and permanency of the ash of a cigar depend," and their presence also "modifies the burning of tobacco in a peculiar way, to the improvement of its flavour, and also positively facilitates burning." In real Manilla tobacco the amount of this substance is above 9 per cent., whilst the ash of the best American tobaccos often contains from 25 to 35 per cent. It will be noticed that, even where a very large quantity of ashes, which would contain a large proportion of potash salts, were applied, the percentage of carbonate of potash in the ash of the tobacco was under 4 per cent. It is a matter of surprise that horse-manure should not have produced a leaf containing more nicotine; probably, however, much of the nitrogenous matter of the manure had been lost; it was old manure from the Artillery stables; the bone-charcoal used, contained when analyzed 57·5 per cent. of phosphate of lime.

Improvement of Farm soils.

51. The *Casuarina trees* planted in 1878-79 continued to progress well during the year, many of them making a great growth; they are now nearly safe from the effects of bad seasons. Those planted in 1879-80 have also done very well on the whole, most of them having been manured early in the year. The watering required was but little, owing to the shade and protection afforded by the dholl sown between the lines for the purpose. One large plot (5 acres) was planted in three portions; in one portion the rows of trees were 4 feet apart and the trees 3 feet apart in the rows; in another the rows were 4 feet and the trees 4½ feet apart; and in the third the rows were 6 feet and the trees 6 feet apart. Of these, the first portion have done much the best, and the last much the worst; but the latter portion is situated on the poorest portion of the field, and many blanks occurred from deaths, which had to be replanted during the year. In the season under report 5·63 acres of poor land were planted out, but the trees have not done well on the whole, chiefly owing to the seedlings being small when planted out, and from not having received adequate attention during the early months of the year. It was not possible to clear and plant much of the remaining waste land during the past year, as the necessary supervision could not be given to it. It is hoped, however, that during the current year the work referred to in paragraph 61 of the last report will be carried out.

Dholl useful shade-plant for Casuarina trees.

52. The *Rotations* commenced in fields Nos. 3 and 16 in 1877-78 were continued during the year. The indigo crop in field No. 3, referred to in paragraph 34 of last year's report, yielded in all 266 bundles of indigo in three cuttings, or at the rate of 149 bundles per acre. The first cutting on April 12th—14th yielded 75 bundles, weighing 6,644 lbs. of plant; the second cut on July 20th gave 26½ bundles, weighing 636 lbs., a part having been cut in June, but rejected, and the third cut on October 2nd—6th yielded 164½ bundles, weighing 10,462 lbs., making a total weight of 17,742 lbs. of green plant. After harvesting the last cutting of indigo, the land was ploughed up immediately and prepared for sowing the next crop in the rotation. *Sorghum saccharatum* was sown on October 12th, 33 lbs. of seed being used; it did not germinate evenly at first, and suffered very severely from the excessive wetness of the weather in November, which prevented the field being properly hoed and cultivated, whilst, at the same time, large portions of it became thoroughly water-logged. The crop was harvested on the 20th February and yielded an outturn of 422 lbs. of grain and 3,373 lbs. of straw.

53. The cotton crop in field No. 16, mentioned in paragraph 35 of the last report, will be found fully dealt with at paragraph 35 in the review of the cotton crops of the year. It gave but a poor yield, partly owing to the circumstances detailed last year,

and partly from the natural poverty of the soil. The cotton plants were taken up at the end of August; but little could be done to the field towards preparation for the next crop until two months later. It was then rapidly ploughed and ridged up for planting Guinea grass; the roots were put in in the usual manner between the 18th and 30th of November, the work being done when the land was too wet to attempt other descriptions of labor on the rest of the farm. The heavy rains at the end of the month were on the whole favorable to this crop, although the extreme wetness of the land, without doubt retarded the first growth of the shoots after planting. At the end of December a portion of the field was manured with certain special manures. The crop grew fairly and remained healthy, and the first cutting, obtained between February 19th and March 4th, yielded 3,616 lbs. of green fodder. The crop still continues to do well, and to look as promising as can be expected on such poor land.

Wet weather utilized for planting Guinea grass.

Rotation in Field No. 3.

1st year (1877-78)—Maize and Cotton (manured).
2nd „ (1878-79)—Indigo (limed).
3rd „ (1879-80)— { Yellow Cholum or Sorghum. / Gingelly.
4th „ (1880-81)—Guinea grass (manured).

Rotation in Field No. 16.

1st year (1877-78)—Castor-oil and Raggi.
2nd „ (1878-79)—Maize and Cotton (manured).
3rd „ (1879-80)—Guinea grass.
4th „ (1880-81)— Do.

MANURES.

54. The manures used during the year were very similar to those used in 1879-80; horse-manure was purchased, also a large quantity of village sweepings were obtained from the Saidapet Local Fund Board, at a charge of one rupee per 12 loads. Besides this, about 8 tons of oil-cake and paddy husk were purchased. Box-manure, sheep-manure, slaughter-house refuse, were also made use of. In the case of sheep-manure, it was possible to make a better use of what was available, as the farm is now supplied with hurdles for use in folding the sheep on the land. A considerable area, 33·37 acres, of horse-gram was also raised and ploughed in as green manure.

55. No. 8 field was selected for a manuring experiment. This field is about $2\frac{1}{2}$ acres in extent, and has been laid out with a view to carrying on continuous manuring experiments for a series of years. The field was levelled some years ago and has a surface fall of about 1 in 300. It is fairly well drained, but surface water does not get off very rapidly. The soil is sandy, but of fair quality, easy to work, and not of too fine or too coarse a texture. Previous to the season of 1879-80 the field was chiefly used for the growth of a variety of crops, and in December 1879 it was sown down with yellow cholum, which yielded in April 1880 a crop at the rate of 547 lbs. of grain and 5,557 lbs. of straw per acre. After this it was laid out in two divisions, each one acre in extent, with a roadway all round and between them. They were then sown at the end of June with horse-gram, which produced a very good crop, estimated at about 14,000 lbs., and was ploughed in at the end of September as green manure. The field was cross-ploughed on October 2nd, and after this the two divisions (A on the north, B on the south) were each sub-divided into ten plots measuring one-tenth of an acre, the divisions being 2 chains in length by $\frac{1}{2}$ chain in width. Between each plot a pathway $1\frac{1}{2}$ feet wide was left in order to mark them clearly, and to prevent, as far as possible, mixture of the soil of adjoining plots. The size and shape of the plots has been found convenient. On the 6th

Experimental plots, great care in laying out.

November each plot was ploughed (gathered) separately, and again on the 15th idem (split) after the application of manures. After harrowing down the furrows, white cholum (*Sorghum vulgare*) was sown across the plots in lines 1 foot apart. This crop was selected owing to the lateness of the season, but even it suffered considerably in point of outturn from being put in so late; it was first checked in growth by the extremely heavy rain at the end of November and beginning of December, and afterwards from the dry weather which set in. The field would have been sown earlier but the work of attending to the careful laying out of the plots and applying the manures was more than the state of Mr. Schiffmayer's health at the time allowed him to do. The crop appeared above ground on the 19th November very evenly over the whole field, but owing to the heavy rains mentioned above, part of that growing in plot A-10 died off from water lodging on the surface. This bed is a little too low and will require raising. As soon as the plants could be seen, those growing in the pathways between the plots were removed. The crop was twice bullock-hoed during December and once hand-hoed in January. During the latter month it made very little progress, and almost appeared as if it would fail, but recovered after the shower that fell on the 12th. During February it commenced to mature, but, so irregularly did it do this, that even by March 16th, when it was harvested, a considerable number of the ears were still unripe, whilst others were more than dead ripe. The straw was short and the sample of grain small; the latter weighed 2·9 lbs. to a Madras measure (100 cubic inches). The crop on one set of plots was so much injured that the results must be left out of consideration as regards this year; excluding these, the general results may be summarised as below.

Manures applied per Acre.	Average Produce per Acre.		Value of Produce per Acre.		Total.
	Grain.	Straw.	Grain.	Straw.	
	LBS.	LBS.	RS.	RS.	RS.
10 tons Box-manure	810·	4,270	16·2	14·23	30·43
Rs. 5 worth Ashes (lbs. 28,600) ...	462·5	2,327·5	9·25	7·76	17·01
Rs. 5 worth Lime (lbs. 2,110) ...	667·5	2,742·5	13·35	9·14	22·49
Rs. 5 worth Cake (lbs. 500)	832·5	3,967·5	16·65	13·22	29·87
None	519·2	2,588	10·384	8·62	19·004

56. It is proposed at the close of every second year to publish the returns of each plot and review the general results. The oil-cake used was decorticated castor-cake in a very fine friable state, purchased here at the rate of 100 lbs. a rupee, and is probably a quick-acting and not a lasting manure. The lime was ordinary shell-lime, in powder after slaking. The box-manure was the ordinary manure made in the cattle boxes under the draught cattle. The ashes were village ashes, such as are easily obtainable; they were said to be chiefly the ashes of paddy husk, but, having been stored without any protection from the weather, must be poor in manurial matter of a soluble nature. The effects of these manures need to be watched for several years. When the outturn from the next crop has been received, it may be possible to make a partial estimate of the value of good box-manure compared with other manurial substances easily procurable in this country.

57. Some experiments have been commenced with a view to demonstrate the relative values of box-manure, cattle-dung and cattle-dung ashes. This is an experiment which will require several years to work out; and, as owing to an error made in conducting the experiment last year, in the manner of collecting box-manure, the results obtained from the use of that manure cannot fairly be compared, with those obtained from cattle-manure in other forms. Only a summary of the results can now be given. In February 1880 three pairs of cattle were set aside and their manure was collected and treated in different ways, the cattle in all cases being fed alike. From one pair the manure was collected on the box system;

from another the solid excrements were collected and thrown into a heap in the open, in the usual manner; and from the third pair the solid excrement, after being made into cakes (bratties), was burnt and the ashes preserved. The manures thus collected were applied to a series of plots in the Experimental Gardens, which were afterwards sown with Planter's Friend, which crop grew well, and the following average results were obtained:—

Plots.	Manure applied.	Outturn.		Comparative Outturn.	
		Grain.	Straw.	Grain.	Straw.
		LBS.	LBS.	LBS.	LBS.
3 and 10 ...	Solid excrements	28·25	191·5	187	121
5 and 8 ...	Cow-dung ashes	21·125	199·5	139	126
2, 4, 7, 9 & 11	None	15·2	158	100	100

58. Four plots in Division E of the Botanical Garden, were manured as shown below and sown with horse-gram (*Dolichos uniflorus*) with the results recorded.

Plot.	Manure.	Outturn of Seed.	Outturn Proportional.
		GRAMMES.	
7	60 lbs. Bone-charcoal ...	285	356
13	3 parahs Village ashes ...	315	393
14	2 do. do. ...	275	343
15	1 do. do. ...	125	100

A parah (4,000 cubic inches) of ashes weighs about 80 lbs. when air-dry, and ashes generally contain considerable quantities of lime in various forms. The farm soils generally are incapable of producing good crops of pulses, probably owing to their containing a very small amount of lime; and the results given above tend to confirm this, as the result of applying lime in considerable quantity caused the production to be very good; that from plot 9 F being at the rate of 892 lbs. per acre, and that from 13 E at the rate of 839 lbs. per acre.

59. Field No. 10-B was divided into two equal sized plots, and one was manured with 8 tons of box-manure and the other with 8 tons of slaughter-house refuse, both manures being spread broadcast and ploughed in. The field was sown on October 1st with maize and cotton, but the maize failed. The cotton was sown in lines alternately 1 foot and $5\frac{3}{4}$ feet apart. The comparative effects of the manures applied on the cotton crop will be shown in the next report.

LIVE STOCK.

60. No progress has been made in the proposed stock-breeding experiment, as the Commissariat slaughter-yards have not yet been removed from the farm. While they remain there, the risk is too great to justify an experiment of the kind with valuable stock, as the facts detailed below fully prove.

61. The *cattle* stock suffered from disease. Early in the year three bullocks died of rinderpest, evidently introduced on the farm through the agency of the cattle going to the slaughter-yards. In December foot-and-mouth disease broke out amongst the cattle; it attacked in all 10 head, of which 7 were of the Aden breed, one a Nellore cow which had been tied up in the same byre as the Aden cattle, and two of the working bullocks. As soon as the disease declared itself, the animals were separated from the other stock and carefully tended by themselves. No fatal results occurred, but the cattle which were attacked were all much weakened. It is worthy of note that this outbreak did not spread to the sheep, and that the outbreak amongst the sheep in the previous year did not spread to cattle.

62. The *Aden cow*, a record of whose milking appeared in paragraph 77 of the last report, continued to give milk up to 26th June last, and thus the total produce received from her during this milking period was as follows :—

—	Quantity.		Value.		
	MEAS.	OLLS.	RS.	A.	P.
September 1879	122	1¾	20	5	11
October „	112	4	18	12	0
November „	117	1½	19	8	6
December „	81	6½	13	10	2
January 1880	104	2½	17	6	2
February „	82	2	13	11	4
March „	81	4½	13	9	6
April „	78	5½	13	1	10
May „	36	7½	6	2	6
June up to 26th, 1880	13	5¼	2	4	5
Total ...	831	1	138	8	4

The charges for maintaining her during the milking period and up to the birth of her next calf in July last, were as stated below, no charge being made for bedding, as the value of the manure would be equal at least to its cost.

	RS.	A.	P.
8,970 lbs. Fodder	29	14	5
647 lbs. Ground-nut cake	12	7	2
26 lbs. Cocoanut cake	2	13	9
208 lbs. Grains of sorts	4	2	7
570 lbs. Bran	11	6	5
518 lbs. Tour	3	13	0
101 lbs. Dholl husk	2	0	4
26 lbs. Salt	0	13	6
Attendance and Sundries	16	7	3
Total ...	83	14	5

Besides yielding the milk mentioned above, she also reared a calf worth about Rs. 20 at the end of the milking period, so that the cost of 831⅛ Madras measures of milk was Rs. 83-14-5, or 1 anna and 7 pies per measure. The cow had thus from May 1877, previous to which no record of her milking was kept, up to July 1880 yielded as follows :—

—	Yield.	
	MEAS. OLLS.	
First period; calved May 1877	832 3	
Second do.; do. June 1878	694 1	
Third do.; do. August 1879	831 1	
Total for 30·5 Months ...	2,357 5	
Average Monthly yield ...	77 3	GALLONS. 28·4

It would be, however, more accurate to take the average of the first and third periods, as, owing to the circumstances mentioned in paragraph 99 of the report for 1878-79, the cow did not yield well during the second period; excluding this period, the average monthly yield of the cow was 81 Madras measures, or 29·3 gallons. This cow calved again on July 19th last, giving birth to another heifer calf, and milking was again begun on the 23rd of that month. She continued to yield milk during the remainder of the year. From December 31st to February 15th she suffered from foot-and-mouth disease, when the milk was not measured, but was thrown away, it being then unfitted for human food. The amount of milk received from the cow during this milking period was as follows:—

—	Quantity.		Value.		
	MEAS.	OLLS.	RS.	A.	P.
July, from 23rd, 1880	30	7	5	2	4
August ,, ...	130	0	21	10	8
September ,, ...	133	0¼	22	2	9
October ,, ...	151	1¼	25	3	1
November ,, ...	140	2	23	6	0
December, to 30th ,, ...	140	2	23	6	0
January 1881...	Sick.				
February, from 16th, ,, ...	28	7½	4	13	2
March ,, ...	90	6½	15	2	2
Total ...	845	2½	140	14	2

These figures show that even the good milk-producing powers of the cow, as shown by the records of her previous milking periods, have been excelled. In the five months from August to December she yielded 694½ Madras measures of milk, or an average monthly yield of 139 Madras measures, or 50·3 gallons. The average monthly yield during the first five months of three previous milking periods was 88·5 Madras measures, or 32 gallons.

63. *Punganúr Cattle.*—In paragraph 79 of the last report it was mentioned that three cows of this breed, with their calves, had been obtained with a view to a trial of their milking capacity being made. The breed has a considerable reputation for milking purposes in the Presidency; but it is stated by some that none of the pure-bred cattle are now to be found. The animals obtained except one, all however appeared to have characteristics distinct from the common small breed of cattle of Southern India. Besides being obtained for the purpose of trial, it was considered advisable to obtain some animals of this breed in order to keep before the students in the Agricultural College, specimens of the different breeds common in the Presidency, and it was hoped that, by crossing it with the Aden breed, it would be possible to effect an improvement, for it was soon found that as regards milking capacity the breed is very poor. In the following table the produce received from these cows from the time they reached the farm until they ceased to yield milk is shown:—

Months.	No. 1.		No. 2.		No. 3.	
	MEAS.	OLLS.	MEAS.	OLLS.	MEAS.	OLLS.
December 1879	27	4½	31	4	...	
January 1880	35	2¾	37	4¾	...	
February „	32	4½	33	5½	25	7
March „	32	4½	33	5	39	5
April „	35	3½	37	6½	39	4
May „	40	2½	41	0½	37	4½
June „	38	1½	39	7	37	1
July „	29	5	26	2½	33	2½
August „	32	0½	7	3	33	6
September „	27	0	...		26	6½
October „	20	7½	...		21	1
November „	7	2½	...		9	5½
Total ...	358	7¼	288	5¾	305	3

This shows that the average monthly yield from these cows during the periods they were yielding milk was 30 measures 6 ollocks or 10·9 gallons, or about one-third of that yielded by the Aden cow. All the cows were crossed with the Aden bull, but, seeing the poorness of the breed, it was determined only to retain one No. 2, and to sell the others as soon as they calved. No. 2 cow calved in November last, dropping a promising calf by the Aden bull imported in June 1874, and No. 1 also calved at the end of February. At the beginning of March, however, an offer having been made to purchase all the cows and calves together, they were sold; it being determined that, when proper facilities for carrying on breeding operations are available, it would be better to obtain fresh stock. During the period after calving in November, cow No. 2 yielded milk as follows:—

—	Quantity.		Value.		
	MEAS.	OLLS.	RS.	A.	P.
November, from 10th, 1880	51	2	8	8	8
December 1880	75	4	12	9	4
January 1881	75	2	12	8	8
February „	61	4	10	4	0
Total ...	263	4	43	14	8

These figures are more satisfactory than those obtained in the previous year, but it must be remembered that, they refer to the period immediately after calving, and that, the cow had been for a year under a course of good feeding and treatment. The cost of keeping this cow from August, up to the end of February, was as follows:—

	RS.	A.	P.
3,330 lbs. Fodder	11	1	7
398½ lbs. Ground-nut Cake	6	3	8
253 lbs. Tour	1	14	8
62¾ lbs. Bran	1	5	4
453 lbs. Dholl husk	9	1	0
144 lbs. Grain	2	14	1
9½ lbs. Salt	0	5	0
Attendance and Sundries	9	4	3
Total ...	42	1	7

64. *Sheep.*—The outbreak of sheep-pox, which committed great havoc amongst the sheep in the latter part of the last official year, continued during the early part

of the present year. There were three distinct outbreaks, as is usual in that disease the total losses during the year under report were 99 head, but many more suffered severely from the disease. As the farm sheep never leave the farm, and are never near any public road, the disease could have been brought to the farm only by means of sheep on their way to the Commissariat slaughter-house.

65. In order to push on the work of improving the breed more rapidly, two half-bred Southdown-Mysore rams were in August purchased from the Mysore Stud Farm at Kunigal. They are well-made animals, with a good deal of the characteristics of the Southdown, and although their wool is far superior to that of our sheep, still a certain amount of hair is mixed with the fleece. It would be advantageous if a few Merino sheep were imported from Australia for the purpose of improving our sheep. A suggestion of this kind was made by James Caird, Esq., C.B., late Famine Commissioner. The lambs from the half-bred Southdown rams are a promising lot, and their wool is decidedly better than that of the lambs of the Saidápet breed. After the disappearance of disease from the flock, 19 rams were sent out into the districts, as shown below :—

Chinglepat	2 Rams.
Bellary	10 do.
Tinnevelly	7 do.

Although the distribution of rams in this manner will lead to some results in improving the breed of indigenous sheep, from the absence of proper supervision, the experiments will not, it is to be feared, be attended with the success desirable. When Agricultural Stations have been established in the districts under competent instructors, it will be possible to do a good deal in the direction of improving the live stock of the country, as good sires can then be looked after properly.

66. In the following table the strength of the flock during the year and the number of deaths are shown, together with similar figures for the past seven years. The abnormal death-rate has been explained above. If the deaths from sheep-pox are excluded the death-rate is 37 per cent., and is even then very high and is attributable to the after-effects of the sheep-pox :—

—	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.	1879-80.	1880-81.
Average number of flock	207	221	237	275	295	274	251	137
Number of deaths	16	24	21	11	31	34	55	*136
Percentage of deaths	7·73	10·9	8·9	4	10·5	13·14	21·9	* 99·2
Rainfall in inches	48·07	68·98	38·14	20·88	65·55	33·16	56·95	57·16

67. In Appendix II of this report the usual statements of stock maintained and the artificial food supplied to them are given, whilst in the following table several interesting particulars regarding them are shown :—

—	1876-77.	1877-78.	1878-79.	1879-80.	1880-81.
Live Stock maintained calculated as country cattle	132	135	123	125	102
Stock, as country cattle, per 100 acres of cultivable land	82·5	84·375	84·24	88	83·65
Percentage of deaths	7·6	12·9	8·9	8·8	16·2
Cost of purchased food a head per mensem	A. P. 8 6	A. P. 10 6	A. P. 14 5	A. P. 12 1	A. P. 12 6

* The death-rate calculated on the stock at the beginning of the year was 53·23 per cent., of which 40 per cent. was from sheep-pox, and the remainder from other causes.

IMPLEMENTS AND MACHINES.

Workshops re-opened late in year.

68. The Workshops not having been re-opened until late in the year, little was done in the manufacture of implements and machines for sale.

Plough trials.

69. On the 18th December some experiments were made in field No. 27 with the undermentioned ploughs, with the results recorded :—

Ploughs.	Furrow.		Cubic Yards of Soil moved in each 100 Yards run.	Draught.
	Depth.	Width.		
	INCHES.	INCHES.		LBS.
1. Ransomes'	3·60	10·30	3·00	277
2. American	3·60	8·50	2·36	289
3. Saidapet	4·50	9·60	3·33	271
4. Cawnpore, without a wheel ...	4·40	6·75	2·29	228
5. Benares Jail	4·20	5·30	1·72	209

American plough.

70. Ransomes' plough is the usual standard plough employed at the farm during plough trials. It is a wheel plough, made entirely of iron, and has been referred to in previous reports. The American plough was introduced on the farm about seven years ago ; it also has been noticed in previous reports. This plough is made of wood, and its working parts are of cast-iron. The great fault in the plough is the abruptness of the mould-board, which, unless the soil is very free and open, causes the draught to be heavy. The weight of this plough is about 34 lbs. The price in Boston was 3 dollars and 38 cents ; delivered in Madras, it cost Rs. 10, but it has since been fitted with a wheel at an additional cost of Rs. 1-12-0. The third plough referred to in the table is a copy of the American plough with some improvements. The price of the plough made up at Saidapet was Rs. 13 ; without a wheel the cost would be Rs. 11½, but the plough does not work well as a "swing" plough. The weight of this plough is about 56 lbs. The Cawnpore plough, to test which the trials were specially made, was received from the Cawnpore farm, North-West Provinces, last year ; it is made of wood, and has iron working parts ; it also is a copy of the American plough just noticed, but has nothing to recommend it. It is certainly light, and low-priced, but then the rude native plough may claim to possess these recommendations. The weight of the plough is 34 lbs. and the price, at Cawnpore, was Rs. 5½. The plough is roughly finished, is without a wheel, and is unfitted to undergo the treatment ploughs usually receive in the field, while it does not turn over the furrow slice efficiently, from the bad form of the mould-board. The Benares Jail plough was received from the Superintendent of the Central Jail at Benares last year. The plough is constructed entirely of iron, it is compact and fairly well made, but does not work satisfactorily ; while, as the section of its furrow is triangular, the amount of work it performs is but small for the draught employed. The weight of the plough is 44 lbs., and its price was Rs. 12. The soil of the field where the ploughs were tried was, on the occasion of the trial, loose and friable excepting in a few places, but, the ploughs were all tried under similar conditions.

Cawnpore plough.

Benares Jail plough.

New Implement.

71. The only new implement made, or introduced, on the farm, during the year, was a small iron grubber, made in the Workshops, the cost of which was Rs. 35. It promises to be a useful implement after

undergoing some slight modifications. It is easily drawn by a pair of cattle, and will scarify about 2½ acres a day; a tillage equal, at the least, to that performed by a country plough, which would not perform one-fourth so much work. The implement will be useful on fallow land, and for cleaning the spaces between the rows of cotton plants, plantains, &c.

Double mhote.

72. Models of the double-mhote water-lift, which still continues to afford good results, were supplied to a number of applicants resident in remote parts of the country. The difficulty of obtaining a suitable material for use in making the mouth-pieces of the water-buckets has not yet been overcome. Leather, such as is procurable at a sufficiently moderate price, is not durable, and strong canvass has been found no more lasting. If further experience confirms the opinion now held, that the Manilla hemp-plant can be grown in this Presidency wherever the plantain is cultivated, the cost of providing the ropes required for the double mhote could be much lessened, by the ryot himself growing the Manilla hemp-plant and making the ropes.

Manilla hemp rope.

Swedish plough.

73. The smaller of the Swedish ploughs received at the farm a few years ago having afforded very satisfactory results, enquiries are being made in Sweden in view to ascertain whether a further supply of these ploughs can be obtained.

Durability of iron plough.

74. It is worthy of record here that several of the iron ploughs supplied to the farm more than twelve years ago, and which have been regularly worked, are still in good order. Of course the working parts have been replaced as necessity arose for this, and the ploughs have been always kept in good repair. They were made by Messrs. Ransomes and Sims and Co. of Ipswich, and Messrs. Howard and Co. of Bedford. The great durability of the ploughs of these eminent manufacturers should be taken into account when the prices charged for their ploughs are being considered. The great aim now appears to be, to procure the ryot a plough at the lowest possible price, without reference to the efficiency, or durability, of the implement. It has been repeatedly pointed out in these reports that a low-priced plough is seldom a cheap implement in the long run. It is highly undesirable that ryots should be induced to purchase low-priced, badly constructed ploughs made of inferior material, with which to institute a better system of tillage; the disappointment that would naturally result would retard, rather than hasten, the general use of improved ploughs.

A very grave error to advise ryots to buy inferior ploughs of the European pattern.

MISCELLANEOUS.

75. *Estate.*—No extensive improvements were carried out during the year; the expenditure incurred on behalf of the estate was chiefly for maintaining the buildings, roads, bridges, water-channels, &c., in good repair. An efficient bridge was constructed over the western channel for the main road to Saidápet.

Property kept in good condition.

76. *Farm Accounts.*—In Appendix III will be found abstract statements of the farm accounts, prepared in the same way as those that were submitted last year. These accounts are incomplete as exhibited. An attempt has been made to show the farm accounts separate from the accounts of the School of Agriculture and those of the department generally. There are several other charges with which the farm might be debited, and there is a good deal which might appear on the credit side of the farm accounts, but this would involve such niceties in accounting, that a large amount of work would be created, for which no corresponding advantage would be gained. Already an annual expenditure of fully 500 rupees is incurred, in keeping the farm accounts, in excess of the cost that would suffice for keeping them if, the farm was an ordinary one; this expense is incurred, in order that the

Cost of keeping farm accounts great.

records may be as complete as possible, and that, the requirements of the Accountant-General's Office, &c., may be complied with; this sum would represent the annual interest on a farming capital of Rupees 10,000 at 5 per cent.

Commercial accounts are unsuited for experimental farming.

77. It has, again and again, been pointed out in these reports that "mercantile" accounts, showing direct profit or loss, are as unsuited for exhibiting the results of the working of an Experimental Farm as such accounts would be for exhibiting the results of the working of the Educational, or other similar State Departments. To do justice to an Experimental Farm, both the *direct* and the *indirect* results that arise from its working, must be valued, and, shown in a balance sheet; and, where are the data to be obtained for calculating the value of either the direct, or the indirect results, beyond those, that are secured at the farm in the shape of cash for produce sold? It must be obvious to all who have given the matter a moment's thought, that the interest the State has in the working of Experimental Farms, is far greater than is represented by the sum it is possible to obtain by the sale of produce raised thereon; else, it would be far better for the State to refrain from engaging in such undertakings, and to seek other investments for the capital on which a mercantile return is sought. *Experimental* farming, is very different from *ordinary* farming.

Indirect results should be valued.

78. In other countries the accounts of Experimental Farms are simple debtor and creditor accounts. It is of course obvious that there should be a limit to expenditure on behalf of Experimental Farms, as there is usually for other undertakings of a similar character; and this, has always been prescribed in the case of the Saidápet Experimental Farm. Until recently, the foregoing facts have generally been admitted, and a simple account, showing expenditure and receipts, has been accepted. And unless the working of the farm is to be altogether changed, no more really satisfactory account can be rendered. The cost of the farm might be reduced were the Commissariat slaughter-yards, so frequently complained of, closed and the buildings made available to the farm, as was approved of some years ago. We have shown, again and again, how remunerative dairy farming is here; but we have been unable to undertake this branch of our work, chiefly, because, we do not feel justified in keeping a number of valuable cows at the farm, exposed, as they would be, to frequent attacks of disease brought by the slaughter-house cattle. From our inability to engage in dairy farming and stock-rearing, which would so specially suit our soils and circumstances, with the direct loss, by deaths, of stock during the year, traceable to disease, which could have reached the farm stock only through the medium of the Commissariat stock, our annual loss would represent a sum quite equal to 30 per cent. of the net annual cost of the farm. However, as long as the objects of the farm are, as at present, experimental and educational, its maintenance must necessarily involve some expense to the State.

Remunerative branches of farming cannot be undertaken.

Great annual loss from slaughter-house on the farm.

79. *Personnel.*—At the commencement of the year Mr. Schiffmayer was in charge of the farm, and continued to be in charge until he proceeded on a month's privilege leave in June, after which he again resumed charge and continued in charge until his health failed in October, when Mr. Benson undertook the duty in addition to his other work until my return at the end of November from furlough. During December Mr. Benson had charge of the farm; towards the end of the month he proceeded on two months' sick leave, when the charge of the farm, along with that of the School of Agriculture, &c., devolved on me. Mr. Benson returned to duty in March, and was in charge of the farm during that month. The health of both Mr. Benson and Mr. Schiffmayer was throughout the year bad; and this, connected with the frequent changes in the direct management, was against the interests of the farm. The results of what was undertaken are, however, as satisfactory as could reasonably have been expected.

80. There is nothing to report regarding the subordinate establishment; some changes have been suggested in view to securing the more efficient practical training of the students of the School of Agriculture, which, it is hoped, will be carried out in the present year.

(Signed) WILLIAM. R. ROBERTSON, M.R.A.C.,
Superintendent of Government Farms.

SAIDAPET,
29*th June* 1881.

APPENDICES.

APPENDIX I.

Statement showing the Monthly Rainfall compared with the Average of the previous Eleven Years.

Month.	1880-81.		Average of 11 Years.	
	Rainfall.	Wet Days.	Rainfall.	Wet Days.
April	...	...	·35	·6
May	...	...	4·13	2·1
June	1·58	8	2·61	5·8
July	4·19	11	3·68	8·7
August	3·12	14	4·99	9·2
September	10·99	10	5·63	8·3
October	10·74	17	11·21	11·2
November	19·62	23	12·70	11·9
December	6·17	10	3·84	5·4
January	·75	1	·82	1·4
February	...	...	1·04	·7
March	...	...	·32	·6
Total ...	57·16	94	51·32	65·9

Statement showing the Weekly Rainfall during 1880-81 *with the Average of the previous Eleven Years.*

Weeks.	1880-81.		Average of the previous 11 Years.		Weeks.	1880-81.		Average of the previous 11 Years.	
	Rainfall.	Wet Days.	Rainfall.	Wet Days.		Rainfall.	Wet Days.	Rainfall.	Wet Days.
1st Week ...	...	...	·20	·18	27th Week ...	·62	3	2·21	2·63
2nd do. ...	...	...	·01	·09	28th do. ...	·34	2	1·51	1·81
3rd do. ...	...	...	·05	·18	29th do. ...	2·03	5	3·14	2·81
4th do. ...	...	...	·01	·09	30th do. ...	7·02	7	3·13	2·90
5th do. ...	...	...	1·40	·54	31st do. ...	3·61	4	2·12	2·54
6th do. ...	...	...	·10	·27	32nd do. ...	5·80	4	2·34	2·27
7th do. ...	...	...	·15	·54	33rd do. ...	2·13	7	4·01	3·90
8th do. ...	...	...	1·19	·55	34th do. ...	3·11	5	2·86	3·09
9th do. ...	...	...	·12	·27	35th do. ...	8·04	5	3·04	2·36
10th do. ...	...	...	·60	·43	36th do. ...	1·27	4	2·03	1·63
11th do. ...	·89	3	1·01	1·27	37th do. ...	...	...	·43	1·63
12th do. ...	·52	3	·31	1·09	38th do. ...	1·70	2	·45	1·18
13th do. ...	·17	2	·44	1·81	39th do. ...	1·00	3	·39	·72
14th do. ..	1·40	3	·46	1·27	40th do. ...	...	...	·02	·27
15th do. ...	·48	4	·84	1·54	41st do. ...	·75	1	...	...
16th do. ...	1·46	1	·85	2·36	42nd do. ...	...	...	·47	·63
17th do. ...	·70	2	·69	2·18	43rd do. ...	...	...	·16	·45
18th do. ...	·28	2	1·35	2·36	44th do. ...	...	...	...	...
19th do. ...	·63	2	1·19	2·45	45th do. ...	...	...	·62	·45
20th do. ...	1·87	5	1·29	2·00	46th do. ...	...	...	...	...
21st do. ...	...	...	·79	2·00	47th do. ...	...	...	·33	·18
22nd do. ...	·49	5	1·23	1·81	48th do. ...	...	...	·04	·09
23rd do. ...	4·45	2	1·72	2·63	49th do. ...	...	...	·14	·36
24th do. ...	6·00	6	1·15	1·81	50th do. ...	...	...	...	...
25th do. ...	...	...	1·44	1·54	51st do. ...	...	...	·27	·18
26th do. ...	·40	1	1·00	1·03	52nd do. ...	...	...	·05	·09

APPENDIX II.

Statement showing the Number of Stock maintained during the Year 1880-81.

	1880.									1881.			Average.
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	
Cattle	43	40	39	38	39	38	38	38	39	35	34	27	37
Sheep	246	211	159	137	124	116	114	100	103	106	115	113	137
Pigs	7	5	5	5	4	4	4	4	4	4	3	3	4
Equivalent as Country Cattle of 300 lbs. live weight.	129	116	111	104	102	100	100	97	100	92	92	78	102

Statement of Artificial Food, including Grains, supplied to Live Stock during the Year 1880-81.

Description of Cattle Food.	Working Cattle.		Cows and their Calves.		Sheep.		Pigs.		Amount supplied.	Value.
	Amount.	Value.	Amount.	Value.	Amount.	Value.	Amount.	Value.		
	LBS.	RS. A. P.	LBS.	RS. A. P.	LBS.	RS. A. P.	LBS.	RS. A. P.	LBS.	RS. A. P.
Ground-nut Cake	*14,916	229 2 2	4,630	71 7 4	25,512	396 14 2	2,863	44 9 0	47,921	742 0 8
Cocoanut Cake	770	77 0 0	212	21 3 2	452	45 3 2	...	...	1,434	143 6 4
Bran	578	12 4 3	734	15 9 4	224	4 12 3	30	0 9 7	1,566	33 3 5
Tour	7,224	54 11 7	3,991	30 3 9	2,030	15 6 1	...	...	13,245	100 5 5
Salt	384¼	12 6 4	85⅜	2 12 0	472	15 3 7	83	2 10 10	1,024⅝	33 0 9
Grains	2,556½	51 5 4	2,696	53 14 9	3,795	75 15 1	...	...	9,047½	181 3 2
Arrowroot tubers	525	10 8 0	...	...	...	...	...	...	525	10 8 0
Dholl husk	...	.....	3,162	63 3 10	...	...	...	...	3,162	63 3 10
Total Rupees ...	...	447 5 8	...	258 6 2	...	553 6 4	...	47 13 5	...	1,306 15 7
Deduct one-third charged to Manure ...	...	149 1 11	...	†	...	184 7 5	...	15 15 2	...	349 8 6
Net Charge ...	...	298 3 9	...	258 6 2	...	368 14 11	...	31 14 3	...	957 7 1
Cost per head per mensem ..	...	0 15 4	...	1 12 9	...	0 3 7	...	0 10 8	...	‡0 12 6

* Includes 144 lbs. Gingelly cake.

† No deduction made, as cows were giving milk.

‡ Calculated on stock as country cattle.

APPENDIX III.

Statement of the Accounts of the Saidápet Farm for the Year 1880-81.

BALANCE SHEET, 31ST MARCH 1881.

Liabilities—	Rs.	A.	P.	*Assets*—	Rs.	A.	P.
Capital	23,936	1	5	Valuation as per statement ...	24,198	0	0
Due sundry persons	350	8	10	Due by sundry persons ...	88	10	3
Total ...	24,286	10	3	Total ...	24,286	10	3

CASH ACCOUNT FOR THE YEAR 1880-81.

Receipts—	Rs.	A.	P.	*Expenditure*—	Rs.	A.	P.
Capital advanced by Government	3,813	2	7	Livestock	1,202	2	9
Livestock	692	3	1	Seeds	116	2	6
Seeds	1,071	6	10	Manures	382	14	8
Implements	595	12	9	Implements and Machines ...	925	4	8
Fruits, Vegetables and Fodder	1,054	11	4	Sundries	210	2	0
Sundries	410	1	5	Labor	3,000	15	4
				Establishment	1,580	8	0
				Despatching Seeds	219	4	1
Total ...	7,637	6	0	Total ...	7,637	6	0

PROFIT AND LOSS ACCOUNT.

	Rs.	A.	P.		Rs.	A.	P.
Establishment	1,582	8	0	Crops	364	5	4
Bad Debt	106	8	0	Sundries	172	4	7
Despatching Seeds	219	4	1	Capital for balance, *i.e.*, cost of the institution	4,310	8	9
Implements and Machines ...	580	5	2				
Labor	495	0	1				
Livestock	1,863	9	4				
Total ...	4,847	2	8	Total ...	4,847	2	8

Valuation of the Saidápet Farm and Estate made on the 31*st March* 1881, *compared with that made on the* 31*st March* 1880.

—	Valuation of Stock on the 31st March 1880.			Increase in the Year.			Decrease in the Year.			Valuation of Stock on the 31st March 1881.		
Farm.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Livestock (*a*)	3,218	0	0	...			1,106	0	0	2,112	0	0
Crops (*b*)	15,144	15	0	1,028	1	0	...			16,173	0	0
Manures	230	0	0	14	0	0	...			244	0	0
Implements (*c*)	5,868	13	3	...			199	13	3	5,669	0	0
	24,461	12	3	...			263	12	3	24,198	0	0
Estate.												
Land (*d*)	36,500	0	0	...			1,500	0	0	35,000	0	0
Buildings (*e*)	22,000	0	0	2,600	0	0	...			24,600	0	0
Wells and Channels (*f*)	7,200	0	0	...			200	0	0	7,000	0	0
	65,700	0	0	900	0	0	...			66,600	0	0

(*a*) Decrease due to sales, deaths, distribution of rams and smaller stock of cattle food.
(*b*) Increase due to young trees, decrease to smaller stock of grain and area of standing crops.
(*c*) Decrease due to sales.
(*d*) Decrease due to land handed over to control of College.
(*e*) Increase due to old buildings omitted last year and improvements.
(*f*) Decrease due to wells, the control over which has been handed over to College, and depreciation.

Resolution—dated 10th December 1881, No. 3182.

Dated 5th December 1881, No. 3059.

In their Proceedings entered in the margin, the Board submitted to Government, with remarks, Mr. Robertson's General Report for 1880-81, and they now offer their observations upon the detailed report of the Saidápet Farm for the same period, premising that the prominent features of the year have already been noticed in their Proceedings quoted.

2. CROPS—*Paragraphs* 13-14.—It is satisfactory to observe that such successful results can be obtained from the cultivation of fodder crops in Southern India; it is, however, to be feared that the smallness of their holdings will generally prevent ryots from profiting from the experience gained in this direction at Saidápet.

3. *Paragraphs* 16-17.—The further experiments made in the cultivation of *black cholum* show that it is less hardy than the Planter's Friend. The outturn per acre of each of these cereals as compared with the previous year was as follows :—

	1880-81.		1879-80.	
	Grain.	Straw.	Grain.	Straw.
	LB.	LB.	LB.	LB.
Black Cholum (*Sorghum Saccaratum*) ..	237	1,895	1,265	8,869
Planter's Friend (*Sorghum Kaffrarium*) ...	951	5,484	588	12,023

The variation is remarkable.

4. At *Paragraphs* 25 *to* 29 full particulars are given regarding the value of these crops as producing sugar,* the outturn of jaggery being found good.

* G.O., dated 18th May 1881, No. 73, p. 8.

5. *Paragraph* 23.—The comparison between the sugar-cane grown upon the farm and cane grown elsewhere shows results favorable to the former; but in the absence of information regarding the relative cost of cultivation, the comparison of crops is of no great value.

6. The statement at *paragraph* 37 contains full particulars of the cost of raising several crops and the value of the harvest in each case. Information of this very practical kind is valuable, and the Board would be glad to see it afforded more freely in the Superintendent's reports.

7. *Paragraphs* 49-50.—The experiments in growing tobacco, though not attended with very marked success, are not altogether discouraging, and show that, although tobacco grown in this country may never be able to compete with that grown in America, it is nevertheless quite possible, by means of judicious treatment of the soil, to improve the indigenous plant very materially. In some of the experiments under notice the percentage of carbonate of potash in the ash of the leaf was nearly 5 per cent., whereas in the tobacco grown upon the farm some years ago it was only ·6 to ·67 per cent.

8. MANURES—*Paragraphs* 54—59.—These paragraphs contain further information on the subject of manures, but the Superintendent is not at present in a position to form any decided opinion from the results obtained. He says that it will be necessary to make observations for several years, though it may be possible to draw a partial conclusion regarding the comparative value of good box-manure when the next crop is harvested.

9. *Paragraphs* 60 *to* 67 relate to *Live Stock.* The most noticeable feature in this chapter is the continued success of the Aden breed of cows as milkers. The Board do not quite follow the Superintendent's calculation of profit at paragraph 62, the method of which, it is observed, differs from that adopted in the previous year when fodder and bedding were both omitted from the list of charges, the manure produced being taken as a set-off against their cost. In the present report the price of bedding alone is excluded on that ground while fodder is charged. Again, while mentioning the value of the calf reared during the season now under report,

the Superintendent has failed to credit it against the cost of maintenance, thus enhancing the cost price of the milk. The general result, however, seems to be that the cow, during the milking period, paid nearly double the cost of her keep. During the current year a fresh consignment of cattle of this breed has been received from Aden.

10. Referring to the remarks at *paragraphs* 77 *and* 78, the Board observe that in his report for the previous year (paragraph 96), Mr. Benson stated that he proposed to set apart certain fields on the northern side of the farm to be worked as a commercial or model as distinguished from an experimental farm. The present report does not show that this intention has been carried out, and the Board again invite Mr. Robertson's attention to the matter, repeating their opinion regarding the beneficial effect upon ryots of demonstrating to them that our methods of farming are, from a financial point of view, better than theirs.

11. The Board note with satisfaction a marked improvement in the style and size of the report under notice as compared with those of previous years.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

To the Secretary to Government, Revenue Department.
,, the Superintendent, Government Farms.
,, all Collectors.

READ—the following letter from H. B. GRIGG, Esq., M.A., Director of Public Instruction, Madras, to the Chief Secretary to Government, Fort St. George, dated Ootacamund, 28th October 1881, No. N-601; and endorsement by E. S. LAFFAN, Esq., Acting Assistant Secretary to Government, dated 2nd November 1881, No. 1764 :—

I have the honor to submit the report of the School of Agriculture for the year 1880-81.

2. The School was in charge of Mr. Benson until the return of Mr. Robertson at the end of November 1880.

3. The Summer Session commenced on the 1st April and terminated on the 30th June 1880.

4. At the beginning of the Session there were two classes in the School: Class II opened in 1878 with 24 students, and Class I formed at the time with 10 students.

5. Fifteen students were paid by Government, two by the Travancore State, three by the Nariad Agricultural Association, and one each by the Holkar, Wadhwan and Gondal States, and the Zamindars of Kálahasti and Kárvetnagar.

6. In the subjects studied, Class II obtained a percentage of marks ranging from 50 to 75, and Class I from 43 to 68. This is good excepting as regards 43, which appertains to Arithmetic; Mr. Robertson ascribing it to the defective knowledge of the subject, which five students brought with them, and who passed the Entrance Examination.

7. At the close of the Session twelve students of Class II, so far as their training had gone, were pronounced qualified to receive first-class certificates, and eleven second-class certificates. Two Bombay students head the list, but otherwise success is pretty equally divided between Madras and Bombay. A single student from Ceylon stands low down.

8. Seven students of the Class I obtained first-class certificates and one a second-class certificate. The Madras students were at the bottom of the list.

9. The Lecturers and Masters speak very well on the whole of the industry and conduct of the students.

10. The Winter Session opened on the 1st of September, and closed on the 31st of March. The classes were the same, but numbered only thirty students: three having left, and one having elected to join the class next formed.

11. In the subjects of examination the percentage of marks gained by Class II ranged from 57 to 69, and that in Class I from 53 to 73. The average in Arithmetic of Class I on this occasion was 73. The improvement is ascribed to the withdrawal from the class of two men who invariably stood low at the Arithmetic Examination.

12. There were only 23 students in Class II, and 12 obtained first-class certificates, while the remaining 11 obtained second-class certificates.

13. Of the seven students in Class I, six obtained first-class certificates, and one a second-class certificate.

14. Three sets of prizes, consisting of three in each set, were provided for Class II. The first prize for ploughing was not awarded. All those for the collection, classification, &c., of the weeds on the Farm, and for work in the Laboratory, and the best notes thereon were however given.

15. Three sets of prizes, consisting of three in each set, were provided for Class I, the best lecture notes being the standard. The second prize for Agriculture was not awarded, and there was no competition for the third prize in Chemistry; but all the other prizes, including those for Botany, were taken.

16. Mr. Robertson reports with reference to Class II and to the subject of Agriculture, that progress was but moderate, and that the conduct of two or three of the students was unsatisfactory. With reference to Class I, he says the conduct and progress of the students were very satisfactory.

17. With reference to Class II, Mr. Benson, in connection with the subject of Practical Agriculture, says that training was carried on under great difficulties, the chief being sickness of the Staff, which led to frequent change of instructors. The students were examined in ploughing in October, the standard being to plough a given area, the students opening their own furrows and working altogether unaided. Some of the work done was very commendable, but in consideration of the time the students had been under training, the general average was not so high as it should have been, and as none of the work was good enough, the first prize was withheld. In other respects the reports of the Lecturers and Masters are on the whole very favorable.

18. It was found impossible to arrange for the delivery of a course of Agriculture Lectures at the Normal School, and arrangements could not conveniently be made for the attendance of Normal Students at Saidápet. The subject is receiving attention.

19. Physical training was carried out in a fairly effective manner under the instruction of a private soldier from a Battery of Artillery at St. Thomas' Mount. The increase in weight and measurement of the students of Class II was not so great as in the preceding year, but this is put down properly to their average age being 23 years. As regards Class I, the students have all increased in weight, but with one exception they have decreased in measurement. Mr. Robertson thinks that this may be due to greater density of muscle, but he feels unable to decide the point. The students are about four years younger than those in Class II. The Gymnastic instructor states that during the whole time he has been careful to give such instruction as would tend to properly develope the bodies of the students and not to overtire or injure them by the performance of Gymnastic feats.

20. The following remarks by Mr. Robertson show that effective measures are taken to test the thoroughness of the instruction. It does not appear to be generally known that the whole of the examinations is compulsory and that, in a course of training, there are, on the average, about 120 examinations. The marks obtained at every one of these examinations are counted in determining the claim of a student to a certificate. The regulations are, for a first-class certificate, that a student must obtain 60 per cent. of the total full marks, and 33 per cent. of the full marks for

each of the various subjects taught; while for a second-class certificate a student must get 40 per cent. of the total marks and 25 per cent. of the full marks for each of the subjects. Under these arrangements, the work is *continuous throughout the whole period of training*, and students have no inducement to cram for any special examination.

21. The payment of lecturers by fees was continued as the most convenient arrangement, though it is far from economical and in other respects open to objection.

22. Much progress has been made in the erection of the permanent buildings for the institution.

23. The Museum has had a few additions made to its collections.

24. The Library and Reading-room were well supplied, and the students made a fair use of them.

25. The building for the Veterinary Hospital has been completed, but quarters are wanted for the hospital-keeper when the Hospital may be opened. It will be under the charge of Mr. Western.

26. The Botanical and Experimental grounds have been maintained in fair order, and considerable additions were made to the collection of plants, shrubs and trees, most of which have been labelled. The proposal to erect a small shed for Meteorological Instruments, and for recording observations, deserves consideration.

27. Mr. Robertson considers that a Field-work instructor should be appointed. He intends, however, to bring up the matter separately.

28. The general control of the institution has been partially transferred from the Board of Revenue to the Director of Public Instruction, but the results of the change have yet to be recorded. It is extremely questionable whether double system of control is likely to be beneficial. I have therefore recently suggested to the Board the transfer of the entire control of the School and Farm to this Department.

29. Mr. Robertson considers that the work of the institution has been fairly well done considering the inconvenient nature of the arrangements under which it had usually to be performed.

30. The expenditure of the institution amounted to Rs. 15,401-2-1.

31. The results are fairly satisfactory, so far as they go; but much remains to be done before the institution can be considered in a position to do the work for which it was established. The Government have recently sanctioned a revised set of rules of admission by which the School is more or less connected with District administration, and Mr. Robertson is now preparing a revised scheme of administration and of study, and, I trust, when the measure is perfected, that the future of the School may be more assured than it now is. The introduction of an Agricultural Branch into the Special Revenue Test, which is contemplated by Government, will doubtless encourage many candidates for Government employ in the Revenue Department, to enter the School.

ENCLOSURE.

From W. R. ROBERTSON, Esq., M.R.A.C., Superintendent, Government Farms, to H. B. GRIGG, Esq., Director of Public Instruction, dated Saidápet, 14th September 1881, No. 921.

I have the honor to submit the Report of the School of Agriculture for the Official Year ending 31st March last.

Endorsement—dated 2nd November 1881, No. 1764.

Transferred to the Revenue Department.

(Signed) E. S. LAFFAN,
Acting Assistant Secretary.

GOVERNMENT SCHOOL OF AGRICULTURE.

SUMMER SESSION OF 1880.

This session commenced on the 1st of April and terminated on the 30th of June. At the beginning of the session there were two classes in the institution. Class II opened in 1878, consisting of 24 students; and Class I, just formed, which contained 10 students.

2. Of these students, 15 received small stipends from Government, 10 were paid stipends provided as below:—

Travancore State	2
Holkar ,, ...	1
Wadhwan ,, ...	1
Gondal ,, ...	1
Kálahasti Zemindari	1
Kárvetnagar ,, ...	1
Nariad Agricultural Assocation	3

and 9 were supported by their friends.

3. The following statement shows the subjects of the several courses of lectures, the number of lectures, classes, and examinations, and the average percentage of marks awarded:—

Subjects.	Class II.			Class I.		
	Lectures and Field Classes.	Examinations.	Average Percentage of Marks.	Lectures and Field Classes.	Examinations.	Average Percentage of Marks.
Agriculture	28	3	61	27	3	66
Veterinary	23	3	50	7	2	68
Chemistry	33	3	58	6	2	63
Botany	31	3	66	14	2	63
Mechanics	21	2	64	...	...	...
Arithmetic and book-keeping.	11	2	65	19	2	43
Mensuration and building.	24	3	75	20	3	64
Field surveying ...	21			11		
Physical Geography...	...	...	...	23	2	62

The low average percentage of marks of Class I for Arithmetic was due to the imperfect knowledge of this subject possessed by three students who gained admission into the class by undergoing the Entrance Examination.

4. The following table shows the marks awarded to the students in Class II in each subject:—

Rank.	Name and Register Number.	Agriculture.	Veterinary.	Chemistry.	Botany.	Mechanics.	Book-keeping.	Building and Surveying.	Total.	Per cent. of Total.	Attendance.	Grand Total.	Examinations passed.
1	33. G. B. Desai	447	296	359	332	126	148	190	1,898	83	158	2,056	VI. Standard, Bombay.
2	34. S. M. Desai	474	235	320	353	136	127	187	1,832	80	165	1,997	Do. do.
3	51. S. A. Baupoo Row	352	234	295	308	132	124	175	1,620	70	141	1,761	Matriculation, Madras University and Method Examination.
4	42. S. Ramasawmy Aiyar	377	239	261	314	117	114	176	1,598	69	144	1,742	Matriculation, Madras University.
5	37. M. Bhavany Shenker Row	384	195	308	242	96	139	167	1,531	67	161	1,692	Do. do.
6	64. K. Padmanabhya	390	214	309	222	94	127	160	1,516	66	144	1,660	Entrance Examination, School of Agriculture.
7	35. B. K. Santaya	383	240	260	265	94	116	144	1,502	65	151	1,653	Matriculation, Madras University.
8	41. V. Rungasawmy Aiyar	379	189	229	279	122	113	176	1,487	65	151	1,638	Do. do.
9	52. M. V. Ramachendra Aiyer	353	224	263	258	87	110	154	1,449	63	143	1,592	Do. do.
10	53. S. Coomarasawmy Moodelly	386	221	258	240	101	94	175	1,475	64	112	1,587	Do. and Précis Writing Higher Grade.
11	56. J. M. Chatrapati	379	223	216	259	94	46	148	1,365	59	158	1,523	VI. Standard, Bombay.
12	46. P. D. Rana	388	188	202	261	82	105	138	1,364	59	152	1,516	Do. do.
13	40. M. V. Vasudeva Aiyer	282	202	256	276	110	106	148	1,380	60	87	1,467	Matriculation, Madras University.
14	43. T. K. Ramen Pillay	389	198	178	264	85	72	126	1,312	57	155	1,467	Do. do.
15	66. V. N. Kristnasawmy Aiyer	309	145	209	251	134	109	150	1,307	57	157	1,464	Do. do.
16	61. R. Ramen Pillai	351	170	177	300	96	71	132	1,297	56	147	1,444	Do. do.
17	58. J. K. Seth	359	163	211	262	95	48	107	1,245	54	139	1,384	VI. Standard, Bombay.
18	57. J. D. Irani	324	227	185	204	67	67	133	1,207	52	153	1,360	Do. do.
19	32. H. K. Desai	398	176	155	190	49	87	138	1,193	52	158	1,351	V. Standard, Bombay.
20	49. P. Ragava Pillay	300	166	237	258	70	63	129	1,223	53	118	1,341	Matriculation, Madras University.
21	38. T. Ramanjulu Naidu	322	155	147	236	99	92	136	1,187	52	147	1,334	General Test, Madras.
22	50. A. Canthyah Moodelly	374	167	152	252	62	51	126	1,184	51	137	1,321	VI. Standard, Ceylon.
23	60. M. Jembunatha Sastry	321	167	167	277	76	88	116	1,212	53	91	1,303	Entrance Examination School of Agriculture.
24	39. G. Jagunathum Naidu	329	119	136	225	84	99	137	1,129	49	121	1,250	General Test Madras.
	Full Marks ..	600	400	400	400	150	150	200	2,300	100	167	2,467	

5. The next table affords similar information regarding Class I.

Rank.	Name and Register Number.	Agriculture.	Veterinary.	Chemistry.	Botany.	Physical Geography.	Arithmetic.	Mensuration and Surveying.	Total.	Per cent. of Total.	Attendance.	Grand Total.	Examinations passed.
1	73. M. J. Bharwada	347	231	254	259	120	111	187	1,509	81	87	1,596	Matriculation, Bombay University.
2	74. R. D. Modi	332	242	266	216	122	84	179	1,441	78	85	1,526	Do. do.
3	70. Jodu Nath Biswas ...	342	263	232	221	115	98	168	1,439	78	83	1,522	Do. Calcutta do.
4	67. Desai Vasoutji Dayabhai ...	326	180	256	256	76	80	167	1,341	72	86	1,427	VI. Standard, Bombay.
5	71. A. W. Jayewardene	371	251	180	225	130	51	125	1,333	72	73	1,406	Do. Ceylon.
6	80. M. Venkataramana Sastry ...	284	221	233	172	95	73	137	1,215	66	65	1,280	Entrance Examination, School of Agriculture.
7	68. M. Kuppusawmy Sastry ...	285	239	266	168	102	88	110	1,228	67	32	1,260	Matriculation, Madras University.
8	78. H. P. D'Vaz	265	247	142	188	78	44	107	1,071	58	83	1,154	Entrance Examination, School of Agriculture.
9	69. S. Samuel Pillay ...	215	139	62	116	54	3	51	640	35	68	708	Do. do.
10	79. N. Raghavendra Row ...	187	48	40	122	28	5	43	473	26	57	530	Do. do.
	Full Marks...	450	300	300	300	150	150	200	1,850	100	95	1,945	

6. At the close of the session, the undermentioned students of Class II were qualified, as far as their training had gone, for certificates as below :—

1st-Class Certificate.

G. B. Desai.	B. K. Santaya.
S. M. Desai.	V. Rungasawmy Aiyer.
S. A. Baupoo Row.	S. Coomarasawmy Moodelly.
S. Ramasawmy Aiyer.	M. V. Ramachendra Aiyer.
M. Bhavany Shenker Row.	M. V. Vasudeva Aiyer.
K. Padmanabhya.	P. D. Rana.

2nd-Class Certificate.

J. M. Chatrapati.	J. D. Irani.
T. K. Ramen Pillay.	H. K. Desai.
V. N. Kristnasawmy Aiyer.	M. Jembunatha Sastry.
R. Ramen Pillay.	T. Ramanjulu Naidu.
J. K. Seth.	A. Canthyah Moodelly.
P. Ragava Pillay.	

7. The students in Class I at the close of the session were, up to that period, qualified for certificates as shown :—

1st-Class Certificate.

M. J. Bharwada.	A. W. Jayewardene.
R. D. Modi.	M. Kuppusawmy Sastry.
Jodu Nath Biswas.	M. Venkataramana Sastry.
Desai Vasoutji Dayabhai.	

2nd-Class Certificate.

H. P. D'Vaz.

8. The following extracts from the reports of the Lecturers and Masters afford information regarding the subjects of the lectures and the general conduct of the students :—

C. BENSON, M.R.A.C., (AGRICULTURE).

CLASS II.

"The subjects discussed in the lectures were the growth and cultivation of cereal, pulse and fodder crops, and the production of sugar.

"The conduct of the class was good, and the students, with one or two exceptions, acquitted themselves well in examinations."

CLASS I.

"Lectures for this class did not commence until the end of April, and were confined to the discussion of the origin, formation, and physical characters of soils.

"The class is a very small one, and the students are of very unequal merit, but the whole acquitted themselves fairly and conducted themselves well."

G. WESTERN, M.R.C.V.S., (VETERINARY).

CLASS II.

"My lectures to Class II during the summer session just past have been on the subject of Veterinary, Materia Medica and Therapeutics. The progress made by the students has been on the whole satisfactory."

CLASS I.

"My subject has been Anatomy and Physiology. The students are attentive and appear fairly intelligent. * * * I am satisfied with their progress so far."

W. HAMILTON (CHEMISTRY).

CLASS II.

"The class was instructed in the Metals and in the Chemistry of organic bodies, including Alcohol and its derivatives.

"The students of this class on the whole have worked steadily and well both at Systematic and Practical Chemistry.

"The conduct of the class has been satisfactory."

CLASS I.

"The subjects taught were those included under the head of 'Chemical Physics.'

"With two exceptions the students have been industrious, and their attainments are very creditable to them.

"The conduct of the whole class has been good."

R. WILKINS, F.R.C.S., (BOTANY).

CLASS II.

"The lectures embraced a description of a few of the remaining natural orders which had not been discussed.

"The conduct of the class was satisfactory."

CLASS I.

"The lectures were on Morphological Botany.

"The class gave satisfaction."

A. GANAPATI AIYER, F.A., (BOOK-KEEPING AND MECHANICS).

CLASS II.

"In Book-keeping — Consignment, Bill Transactions and questions bearing on them were taught; and in Mechanics, parallel forces, &c.

"The general conduct of the students was satisfactory."

ARITHMETIC AND PHYSICAL GEOGRAPHY.

CLASS I.

"Arthmetic—Vulgar and Decimal Fractions, Practice, Simple and Compound Proportion.

"Physical Geography—Clouds, rain, dew, springs, rivers, ice and its work.

"Conduct satisfactory."

T. V. SEETHARAM MOODELLY (MENSURATION AND BUILDING).

CLASS II.

"In Levelling—Simple and Compound Levelling.

"In Building—Scantling of roof timbers and the modes of construction of roofs as exhibited in the buildings on the Farm.

"The class, with very few exceptions, have been industrious."

MENSURATION AND SURVEYING.

CLASS I.

"The subjects taught were Principles of Geometry, the measurement of lines and sketching and surveying small fields.

"The conduct of these students has been excellent."

WINTER SESSION OF 1881.

9. This session opened on the 1st of September, and ended on the 31st of March. The classes in the institution were the same as in the preceding session; but they contained only 30 students, three having left the institution, and one having withdrawn from his class to join that next formed.

10. The next statement exhibits the subjects of the several courses of lectures, the number of lectures, classes and examinations held during the session, and the average percentage of marks awarded:—

Subjects.	Class II.			Class I.		
	Lectures and Field Classes.	Examinations.	Average Percentage of Marks.	Lectures and Field Classes.	Examinations.	Average Percentage of Marks.
Agriculture	78	5	64	72	5	72
Veterinary	42	4	60	42	4	63
Chemistry	61	4	57	37	4	53
Botany	64	4	59	46	4	70
Mechanics	24	3	69	..	..	..
Arithmetic and Book-keeping	10	1	57	36	3	73
Mensuration, Building, Estimating and Plan-drawing.	33	3	69	64	4	72
Field-surveying	34			21		
Physical Geography and Meteorology	..	..	..	15	3	72

It will be observed that Class I gained a higher average percentage of marks in Arithmetic than in the preceding session; this must be attributed to the withdrawal from the class of two men who invariably stood low at Arithmetic examinations.

11. The table that follows exhibits the marks awarded to each student in Class II at the examinations in each subject of instruction.

Rank.	Name and Register Number.	Agriculture.	Veterinary.	Chemistry.	Botany.	Mechanics.	Book-keeping.	Surveying, Estimating and Building.	Total.	Per cent. of Total.	Attendance.	Grand Total.
1	33. G. B. Desai	569	411	410	343	107	35	134	2,009	79	272	2,281
2	42. S. Ramasawmy Aiyer	480	376	339	406	137	30	136	1,904	75	312	2,216
3	37. M. Bhavany Shenker Row ..	536	369	367	326	115	41	127	1,881	74	292	2,173
4	35. B. K. Santaya	501	334	323	340	113	32	117	1,760	69	280	2,040
5	64. K. Padmanabhya	460	306	373	332	116	32	122	1,741	68	274	2,015
6	34. S. M. Desai	452	310	371	326	127	36	118	1,740	68	264	2,004
7	51. S. A. Baupoo Row	457	364	335	338	128	25	125	1,772	69	220	1,992
8	52. M. V. Ramachendra Aiyer.. ..	454	309	314	304	102	32	114	1,629	64	309	1,938
9	46. P. D. Rana	446	337	270	317	108	27	95	1,600	63	286	1,886
10	40. M. V. Vasudeva Aiyer	424	293	300	308	126	39	119	1,609	63	248	1,857
11	61. R. Ramen Pillay	470	336	271	286	88	24	74	1,549	61	270	1,819
12	43. T. K. Ramen Pillay	406	333	293	295	114	15	88	1,544	61	247	1,791
13	41. V. Rungasawmy Aiyer	408	291	261	268	130	42	139	1,539	60	245	1,784
14	57. J. D. Irani	456	353	263	251	67	17	61	1,468	58	282	1,750
15	66. V. N. Kristnasawmy Aiyer ..	425	241	266	276	127	24	99	1,458	57	286	1,744
16	56. J. M. Chatrapati	461	271	274	250	77	25	91	1,449	57	256	1,705
17	38. T. Ramanjulu Naidu	428	257	223	314	74	27	114	1,437	56	264	1,701
18	49. P. Ragava Pillay	444	208	260	289	77	18	94	1,390	55	250	1,640
19	60. M. Jembunatha Sastry	389	245	257	281	80	19	84	1,355	53	249	1,604
20	58. J. K. Seth	435	240	201	244	94	26	71	1,311	51	245	1,556
21	32. H. K. Desai	443	255	187	258	64	27	81	1,315	52	240	1,555
22	53. S. Coomarasawmy Moodelly ..	447	302	269	315	96	25	95	1,549	61	..	1,549
23	50. A. Canthyah Moodelly	409	272	200	259	92	31	68	1,331	52	162	1,493
	Full Marks ..	700	500	500	500	150	50	150	2,550	100	342	2,892

12. Similar information is afforded in the next table regarding Class I:—

Rank.	Name and Register Number.	Agriculture.	Veterinary.	Chemistry.	Botany.	Physical Geography and Meteorology.	Arithmetic.	Mensuration and Surveying.	Total.	Per cent. of Total.	Attendance.	Grand Total.
1	73. M. J. Bharwada	558	405	366	424	132	136	164	2,185	81	290	2,475
2	74. R. D. Modi	512	341	329	374	111	128	175	1,970	73	287	2,257
3	68. M. Kuppusawmi Sastry ..	494	301	282	391	124	137	178	1,907	71	299	2,206
4	80. M. Venkatarmana Sastry ..	504	337	235	311	105	116	165	1,773	66	338	2,111
5	70. Jodu Nath Biswas	496	339	242	296	110	94	138	1,715	64	285	2,000
6	67. Desai Vasoutji Dayabhai ..	512	272	248	328	101	82	128	1,671	62	250	1,921
7	78. H. P. D'Vaz	421	205	147	296	73	71	57	1,270	47	227	1,497
	Full Marks ..	700	500	500	500	150	150	200	2,700	100	354	3,054

13. At the end of the session, the undermentioned students of Class II had qualified up to date for certificates as below:—

1st-Class Certificate.

G. B. Desai.
S. Ramasawmy Aiyer.
M. Bhavany Shenker Row.
S. A. Baupoo Row.
B. K. Santaya.
K. Padmanabhya.
S. M. Desai.
M. V. Ramachendra Aiyer.
M. V. Vasudeva Aiyer.
P. D. Rana.
S. Coomarasawmy Moodelly.
V. Rungasawmy Aiyer.

2nd-Class Certificate.

R. Ramen Pillay.
T. K. Ramen Pillay.
J. D. Irani.
V. N. Kristnasawmy Aiyer.
J. M. Chatrapati.
T. Ramanjulu Naidu.
P. Ragava Pillay.
M. Jembunatha Sastry.
A. Canthyah Moodelly.
H. K Desai.
J. K. Seth.

14. In Class I the following students had, as far as their training had proceeded, become qualified for certificates as shown :—

1st-Class Certificate.

M. J. Bharwada.	M. Venkataramana Sastry.
R D. Modi.	Jodu Nath Biswas.
M. Kuppusawmi Sastry.	Desai Vasoutji Dayabhai.

2nd-Class Certificate.

H. P. D'Vaz.

15. The following prizes were awarded during this session to Class II :—

For ploughing	1st Prize,	Not awarded.
	2nd ,,	S. M. Desai.
	3rd ,,	S. A. Baupoo Row.
For collection of weeds of the Farm, named, classified, &c.	1st Prize,	K. Padmanabhya.
	2nd ,,	M. Bhavany Shenker Row.
	3rd ,,	Not awarded.
For work in the Laboratory and the best notes thereon.	1st Prize,	G. B. Desai.
	2nd ,,	M. Bhavany Shenker Row.
	3rd ,,	S. M. Desai.

16. In Class I the following prizes were awarded for the best lecture notes :—

Agriculture	1st Prize,	M. J. Bharwada.
	2nd ,,	Not awarded.
	3rd ,,	R. D. Modi, M. Kuppusawmy Sastry.
Chemistry	1st Prize,	M. J. Bharwada.
	2nd ,,	R. D. Modi.
	3rd ,,	No competition.
Botany	1st Prize,	Deasi Vasoutji Dayabhi.
	2nd ,,	M. J. Bharwada.
	3rd ,,	R. D. Modi.

17. The following extracts from the reports of the Lecturers and Masters afford information regarding the subjects of the lectures and the general conduct of the students :—

W. R. ROBERTSON, M.R.A.C., (AGRICULTURE).

CLASS II.

"Mr. Benson conducted the class during the early part of the session, after which I took charge of it. The subject of the lectures were Indigo, Tobacco, Coffee, Tea, and other special crops, and the breeding and management of live stock.

"The progress of the class was but moderate, and the conduct of two or three of its members was unsatisfactory."

CLASS I.

"This class also in the early part of the session was conducted by Mr. Benson, who gave over the charge of it to me on my return from furlough. The subjects of the lectures were soils, their classification and improvement, agricultural implements, &c.

"During a portion of January and February, Mr. Ganapati Aiyer had charge of this class when a portion of the Saidápet Farm Manual was gone through.

"The conduct of these students was very satisfactory, as also was their progress."

C. BENSON, M.R.A.C., (PRACTICAL AGRICULTURE).

CLASS II.

"During the past session, the training of the classes in practical agriculture was carried on under great difficulties owing to various causes, the chief being the sickness of the staff. The instructing officer was frequently changed. During September, in order to obtain closer attention to the subject and no lectures being delivered at the time, I took up the Farm classes of ClassII, whilst Mr. Schiffmayer devoted his whole attention to the instruction of Class I; the students in rotation being under his orders daily, in the morning and evening. In the early part of October, Mr. Schiffmayer as usual undertook the Farm classes of both classes; but when his health failed towards the middle of the month, I took up this work in addition to my own, and continued to perform it during November. During December, the Farm classes were my special work until I proceeded on leave, when they were undertaken by you during my absence until the beginning of March, when I resumed the work.

"The subjects discussed at these classes chiefly referred to the current operations of, and the experiments proceeding on the Farm, and to the crops growing. The students of this class were examined in ploughing in October last, the standard set being to plough a given area, the students opening their own furrows and working altogether unaided. Some of the work done was very commendable, but considering the time the students had been under training, the general average was not so high as it should have been, and none was good enough to enable me to award the first prize offered at the time.

"In the class the conduct of the students was good."

CLASS I.

"Attention was chiefly given to the methods of using the various implements and tools in use on the Farm, their advantages and disadvantages, and to the operations of cultivation, which were proceeding during the session.

"In the class, the conduct of the students was good, and many of them attained, under the careful individual instruction given them during September, considerable proficiency in various forms of practical work."

G. WESTERN, M.R.C.V.S., (VETERINARY).

CLASS II.

"The subjects of the lectures were Cattle-diseases and their treatment.

"The students of Class II have also continued to give me every satisfaction."

CLASS I.

"The subjects of the lectures were Physiology and Anatomy.

"They are always attentive and, with one exception, have made fair progress in their studies."

W. HAMILTON (CHEMISTRY).

CLASS II.

"The lectures comprised the subjects of Organic Chemistry (the concluding portion), and Agricultural Chemistry.

"The lectures were illustrated by experiments whenever practicable.

"The students of this class are of average ability, and I was fairly satisfied with their conduct, industry and progress.

"In the practical class, the subject of qualitative analysis was taught, with special reference to agricultural substances."

CLASS I.

"The lectures were illustrated by experiments, and the use of apparatus was shown.

"The elements of the non-metallic group constituted the subject of the course.

"The students of this class have, on the whole, been well conducted and, with some exceptions, have been industrious, and have made respectable progress."

R. WILKINS, F.R.C.S., (BOTANY).

CLASS II.

"The lectures embraced Horticultural and Economic Botany. They had practical instruction in the Botanical garden attached to the College.

"The conduct and progress of this class have been good."

CLASS I.

"Most of the students worked very satisfactorily.

"They have had all the subjects connected with Morphology, and at the close of the session they were getting the physiology of plants."

A GANAPATI AIYER, F.A., (BOOK-KEEPING AND MECHANICS).

CLASS II.

The following subjects were treated of—

"Book-keeping—Making Balance Sheet direct from Trial Balance, Interest and Partnership.

Mechanics—Levers, Pulleys, Wheel and Axle, Toothed Wheels, Inclined Plane, The Screw, The Wedge, Friction and Dynomometer were referred to in detail.

"The class acquitted itself very well at the examinations held in both these subjects."

ARITHMETIC, PHYSICAL GEOGRAPHY AND METEOROLOGY.

CLASS I.

"Arithmetic—Double Proportion, Simple and Compound Interest, Present Worth and Discount, Profit and Loss, Percentage and Proportional Parts were done.

"Physical Geography and Meteorology—The portions taught were Earthquakes and Volcanoes, Formation of Lands, Thermometer, The Barometer and their readings and corrections were explained in detail.

"The class made satisfactory progress in all the above subjects.

"The general conduct of the students in this and Class II was satisfactory."

T. V. SEETHARAM MOODELLY (LEVELLING AND BUILDING).

CLASS II.

"Subjects taught were levelling, drawing and estimating for ordinary estate buildings, mode of laying out roads, also the uses and value of different building materials.

"On the whole the students worked satisfactorily and made good progress."

(MENSURATION AND SURVEYING.)

CLASS I.

"Subjects taught were surveying large areas with chain and plotting and computing mensuration of surfaces.

"The conduct of the class has been good."

18. *Government Normal School.*—It was found impossible to arrange for the delivery of a course of agricultural lectures at the Government Normal School, and, unfortunately, arrangements could not conveniently be made by the authorities of that institution to allow their students to attend lectures at Saidápet. This is much to be regretted, for even though the knowledge gained at a short course of agricultural lectures cannot but be slight, it must be of some service in after life to teachers employed in rural schools, especially now that an agricultural text book is in use in the schools.

19. *Physical Training.*—Physical training was continued during both sessions; Class II for the whole period, and Class I from 28th October, excepting during vacations.

20. The two classes met together for two hours once a week. At these gatherings, the students were drilled and trained in sub-classes according to their abilities and progress. The general system of training was that laid down in "Dr. Maclarens' Physical Training," chiefly exercises in movements of the body and in the use of dumb-bells, the vaulting-horse, the parallel bars, &c. The Instructor is a Private from a Battery of the Royal Artillery stationed at St. Thomas' Mount; he appears to take much interest in his classes.

21. The next table gives full details of the weighings and measurements of each student in Class II:—

Name and Register Number.	Age.	Measurements and Weights on the 1st April 1880.					Measurements and Weights on the 31st March 1881.					Increase.					Decrease.					Remarks.
		Height.	Weight.	Chest.	Forearm.	Upper arm.	Weight.	Chest.	Forearm.	Upper arm.	Weight.	Chest.	Forearm.	Upper arm.	Weight.	Chest.	Forearm.	Upper arm.			
	YEARS.	INCS.	LB.	INCS.	INCS.	INCS.	LB.	INCS.	INCS.	INCS.	LB.	INCS.	INCS.	INCS.	LB.	INCS.	INCS.	INCS.			
32. H. K. Desai	24	64⅜	132½	32⅞	10½	11⅛	132	33	10¼	11⅜	..	¼	..	..	½	..	¼	..			
33. G. B. Desai	19	66	99¾	30	9	9⅝	100	30	9¼	10¼	¼	..	..	..	..	..	..	..			
34. S. M. Desai	19	64½	125	34	10	11¼	139½	35½	10¼	12⅝	14½	1½	..	..	..	..	..	..			
35. B. K. Santaya	21	68	114	34⅜	9⅞	10	111¾	31	9¾	10	..	..	..	..	2⅝	..	..	¾			
37. M. Bhavani Shenker Row	21½	68¼	114	31⅝	9⅝	10⅜	108	30	9¼	10	..	..	..	..	6	1½	..	¼			
38. T. Ramanjulu Naidu ..	22	65⅞	123⅜	31	9⅝	11¼	125	32½	9½	11⅜	1½	1½	..	..	..	..	..	..			
39. G. Jagunathum Naidu ..	22	68¼	105¼	31¼	9¾	10¼	..	..	..	..	..	..	..	..	..	..	..	..			
40. M. V. Vasudeva Aiyer ..	19	62⅝	120⅛	32	10	12	121	31½	10⅜	12	½	..	..	..	..	..	..	..		Left.	
41. V. Rungasawmy Aiyer ..	23	60½	99	32	9⅝	10⅜	92	31	9	9⅜	..	..	..	..	7	1	..	..		Sick.	
42. S. Ramaswmy Aiyer ..	22	70	124	31⅜	9¼	10¼	118	30½	9⅛	9¾	..	..	..	..	6	1½	..	¾		Sick.	
43. T. K. Ramen Pillay ..	24	67	112	31¼	9¼	10⅛	111	30⅜	9⅛	10	..	..	..	..	1	..	..	..			
46. P. D. Rana	22	64	132	36	10⅜	12⅜	136	36	11	12⅝	4	..	..	..	..	..	..	..			
49. P. Ragava Pillay	23	63	88	28	8¼	9⅜	100	30	9¼	10¼	12	2	..	..	..	..	..	..			
50. A. Canthyah Moodelly ..	25	69	127½	32⅜	9⅜	10¼	130	33¼	9⅜	10⅝	2½	½	..	..	..	..	..	..			
51. S. A. Baupoo Row	25	58⅜	86	30	9¼	9⅜	88	30¼	9⅜	10⅜	2	1	..	1	..	..	..	..			
52. M. V. Ramachendra Aiyer	23	64½	101	29¼	9½	10⅜	98	30½	9⅝	10¼	..	½	..	..	3	..	..	..			
53. S. Coomarasawmy Moodelly	23	65⅝	105½	29	9	10	110	29⅜	9¼	10¼	4½	½	..	..	..	..	..	..			
56. J. M. Chatrapati	25	68⅛	127⅝	36½	9⅜	10⅜	134	37⅛	10	11⅛	6½	1	..	..	..	..	..	..			
57. J. D. Irani	21	66⅜	127	32⅛	10¼	12	125½	32⅝	10½	12	..	¼	..	..	1½	..	..	¼			
58. J. K. Seth	22	65¼	138	36	11¼	13	138	35½	11	13¼	..	..	..	..	..	..	..	..			
60. M. Jambunatha Sastry ..	28½	63	140	36¼	10¼	11⅛	140	37¼	10¼	11⅜	..	1	¼	..	..	1	..	..			
61. R. Ramen Pillay	28	64⅜	115	32⅜	10	10⅝	112	31⅜	9½	10	..	..	..	..	3	..	..	..			
64. K. Padmanabhya	22	64⅜	101	30	9⅜	10¼	96	30	9⅜	10⅛	..	..	..	..	5	1	..	¼			
66. V. N. Kristnasawmy Iyer ..	21	63⅜	113½	31	9⅜	11	118	31⅛	10	11⅛	4½	¾	¼	¼	..	..	..	..			

22. The following shows the average increase in the weights and measurements of these men :—

	Increase.
Weight	1·45 lb.
Chest measurements..	·30 inches.
Fore-arm	·22 „
Upper-arm	·19 „

The increases are not so great as in the preceding year, but this only could be expected. The average age of the men in this class was 23 years.

23. The variations in the average weighings and measurements of the students in Class I are shown below :—

	Increase.	Decrease.
	lb.	In.
Weight	4·89	...
Chest	...	·86
Fore-arm	...	·39
Upper-arm	...	·53

Though each student has gained in weight nearly 5 lb., all, with one exception, have decreased in body measurements. I cannot understand this, excepting that it may be due to a greater density in the muscle of their bodies—it having become firmer and more compact under the influences of the training and the out-of-door employment. It must, however, be remembered that, omitting holidays, the class was under training only about 4½ months, so that these youths could not have attended more than 14 practice meetings; while the average age of the members of the class is about 4 years below that of the students in Class II. Perhaps, as their training continues, they will show more satisfactory results in their measurements.

24. The Gymnastic Instructor reports as follows :—

"The students under my charge during the recent sessions have been instructed in the use of dumb bells, dumb-bars, parallel bars, horizontal bar and the vaulting-horse.

"During the whole time, I have been most careful to give such instructions as would tend to properly develope the bodies of the students and not to overtire or injure them by the performance of gymnastic feats."

25. *College Examinations.*—It does not appear to be generally known that the whole of the examinations are compulsory, and that in a course of training there are on the average about 120 examinations. The marks obtained at every one of these examinations are counted in determining the claim of a student to a certificate. The regulations are, for a 1st-class certificate, that a student must obtain 60 per cent. of the total full marks and 33 per cent. of the full marks for each of the various subjects taught in the College; while for a 2nd-class certificate, a student must get 40 per cent. of the total marks and 25 per cent. of the full marks for each of the subjects. Under these arrangements, the work is *continuous throughout the whole period of training* and students have no inducement to cram for any special examinations.

26. *Lecture Fee System.*—This arrangement still continues in force; though convenient, it is far from economical.

27. *Accommodation.*—Much progress has been made in erecting the permanent buildings. It is hoped that two lecture-rooms and three large class-rooms will be available for use early in October when the temporary sheds now in use will be removed.

28. *Museum.*—A few additions have been made to the collections, but nothing worthy of special notice. Efforts will be made when the graduates of the institution are more scattered over the country, to enlist their services in forming more extensive collections of agricultural productions, soils, tools, &c., likely to be of use in illustrating lectures.

29. *Library and Reading Room.*—Eighty-three volumes have been added to the library and the undermentioned periodicals were supplied to the Reading Room during the year :—

"Southern Cultivator."	"Journal of the Society of Arts."
"Agricultural Gazette."	"Ceylon Observer."
"Indian Agriculturist."	"Madras Journal of Education."
"Nature."	

The students made a fair use of the books both of "reference" and those for "circulation."

The following statement shows the number of works in the library and the number taken out to read by students. Works of reference cannot be removed from the library:—

Subject of Works.	Number in the Library.		Number taken out by Students.
	Ordinary.	Reference.	
Agriculture, Horticulture and Arboriculture	186	133	182
Botany and Vegetable Physiology	36	10	17
Veterinary, Zoology and Animal Physiology	92	15	78
Chemistry and Mineralogy ...	59	2	57
Geology and Engineering ...	103	23	25
Other Works	82	95	45
Total ...	558	278	404

30. *Veterinary Hospital.*—The buildings for this institution have been completed. It is now only necessary to provide the quarters for the hospital keeper to admit of the institution being opened. Its general charge will be in the hands of G. Western, Esq., M.R.C.V.S., the Veterinary Lecturer in the College.

31. *Botanical and Experimental Grounds.*—These have been maintained in fair order A number of small experiments have been conducted in these grounds which could not be carried out in the fields. Considerable additions have been made to the collections of plants, shrubs and trees, most of which have been labelled with their scientific and common names. It is proposed to erect a small shed for meteorological instruments and to record such meteorological observations as will prove of use.

32. *Practical Instruction.*—The arrangements for conducting this portion of our work are unsatisfactory at present. It appears to be necessary that a Field-work instructor should be appointed, who could always be with the students when they are engaged on Farm duty. This matter will, however, be separately dealt with.

33. *Transfer of general control.*—The general control of the institution has recently been transferred from the Board of Revenue to that of the Director of Public Instruction. It is hoped that the interests of the College will be benefitted by this change.

34. *Management and Teaching Staff.*—The management of the institution was in the hands of C. Benson, Esq., up to the end of November, when I returned from furlough and resumed charge. During my absence, the duties of the Agricultural lectureship were performed by Mr. Benson. There was no other change of importance during the year.

35. *Establishment, &c.*—I have nothing to notice regarding the establishment that specially deserves attention. The work has been fairly well done, considering the inconvenient arrangements under which it has usually had to be performed.

36. In the appendix, I give the usual statement showing the detailed expenditure on behalf of the institution.

APPENDIX I.

Statement of Expenditure on account of the Madras School of Agriculture during the Year 1880-81.

	1880.									1881.			Total.	Grand Total.
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.		
ORDINARY.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Lecture Fees.														
Agricultural Lectures ..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Veterinary do. ..	120 0 0	180 0 0	260 0 0	260 0 0	..	..	..	280 0 0	320 0 0	320 0 0	200 0 0	360 0 0	2,300 0 0	
Chemical do. ..	200 0 0	260 0 0	300 0 0	320 0 0	..	..	..	240 0 0	320 0 0	360 0 0	300 0 0	440 0 0	2,740 0 0	
Botanical do. ..	120 0 0	180 0 0	260 0 0	240 0 0	..	..	..	200 0 0	240 0 0	220 0 0	200 0 0	280 0 0	1,940 0 0	
														6,980 0 0
Salaries and Wages.														
Masters	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	250 0 0	3,000 0 0	
Clerk and inferior Servants..	76 0 0	75 14 0	75 12 0	74 12 0	76 0 0	76 0 0	76 0 0	76 0 0	76 0 0	74 0 0	76 0 0	76 0 0	908 6 0	
Gymnastic Instructor ..	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	20 0 0	240 0 0	
														4,148 6 0
Stipends and Scholarships.														
Stipendiary Studentships ..	180 0 0	180 0 0	180 0 0	180 0 0	180 0 0	180 0 0	112 12 10	189 0 0	189 0 0	189 0 0	189 0 0	186 10 3	2,135 7 1	
Scholarships	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	30 0 0	360 0 0	
														2,495 7 1
Miscellaneous.														
Prizes	..	..	39 8 0	..	..	..	..	..	..	12 0 0	..	12 0 0	63 8 0	
Books for the Library ..	*21 9 1	..	..	..	..	90 12 8	*32 14 4	..	..	..	46 0 0	..	191 4 1	
Contingencies	35 6 9	30 10 3	155 12 2	37 12 0	2 0 0	5 9 3	14 11 5	8 12 0	20 6 2	33 8 3	49 12 7	81 15 0	476 3 10	
Laboratory Charges	2 1 0	4 6 6	131 3 6	0 6 0	..	..	..	12 6 0	5 15 0	1 10 9	1 6 6	3 1 0	162 8 3	
Botanical Grounds	37 10 9	42 11 10	53 15 11	39 7 10	37 11 2	41 4 7	68 14 9	39 11 4	39 0 6	39 13 8	47 13 2	264 2 10	752 6 4	
Maintenance of Buildings ..	..	..	..	..	..	..	100 0 0	21 0 0	10 6 6	..	..	..	131 6 6	
														1,777 5 0
EXTRAORDINARY.														
Veterinary Hospital ..	..	..	..	..	..	..	..	..	..	..	..	..	..	
School of Agriculture ..	..	..	..	..	..	..	..	..	..	..	..	..	..	
													Total ..	15,401 2 1

* Charges for Newspapers paid at the Accountant-General's Office.

ORDER—dated 28th June 1882, No. 650, Revenue.

Miscellaneous.

With the first two papers read above, the Board of Revenue submit, with a full summary, the reports of the Superintendent of Government Farms on the operations of his Department generally, and on those at the Saidápet Experimental Farm specially. The Director of Public Instruction submits Mr. Robertson's Report on the School of Agriculture. The Government briefly review in these Proceedings the three reports noted above.

General.—Mr. Benson's tour in the Bellary District was the only one made by the officers of the Agricultural Department. His interesting report has been separately received and disposed of (G.O., 13th July 1881, No. 1067). The Government have more than once urged the desirability of frequent tours being undertaken. Mr. Robertson's attention will again be directed to the matter.

A proposal for holding periodical agricultural exhibitions in several parts of the Presidency has recently been approved (G.O., No. 257, dated 3rd March 1882).

Mr. Robertson regrets that seeds for experimental cultivation were not distributed on a larger scale, and suggests that the matter should receive the attention of the State. The separate proposal on the subject promised by Mr. Robertson is awaited. Reports on the experimental cultivation of *Sorghum saccaratum* and "Planter's Friend" are on the whole very satisfactory. Mr. Robertson notes, however, that in none of the districts was any attempt made to extract the most valuable product of the plant, viz., its saccharine juices.

The account of the series of ploughing matches held in Bellary is interesting. A proposal for holding similar ploughing exhibitions in Cuddapah and Kurnool has lately been sanctioned by the Board of Revenue, and if the results should be found as satisfactory as those in Bellary, further exhibitions should be held in other districts. The Government have read with much pleasure M.R.Ry. Krishnasawmi Moodelliar's account of his laudable attempts to improve native husbandry, and desire that Mr. Robertson will, at no very distant date, visit this gentleman's estates and report on the results of the improved methods of cultivation which have lately been introduced there.

The Saidápet Experimental Farm.—The season on the whole was favorable. The rainfall was greater than in the last ten years, and was distributed over a longer period.

The Behea Sugar-mill is reported to have worked very satisfactorily. The Government think it desirable that the results of its working as compared with those of the indigenous sugar-mill should be widely published.

Arrow-root is reported to have succeeded remarkably well, so much so that by selling the flour at 4 annas a pound over 400 rupees per acre could be realized. This is a remarkable return and should also be published for the information of the public.

Experiments in growing tobacco have proved that the plant, when grown in this country, cannot compete successfully with American tobacco. Much, however, still remains to be done in the judicious treatment of the soil in which the plant is grown.

Experiments were made to ascertain the comparative value of different kinds of manure. But Mr. Robertson is not in a position at present to form any decided opinion on the subject.

Live-stock.—The Aden cows have maintained their reputation as milkers, and a fresh consignment of cattle has recently been obtained from Aden. The Government regret to learn that the Punganúr cattle have been found, as regard their milking capacity, not to come up to expectations. Attempts might, however, be made to cross this breed with the Aden bull as it is possible that the cross breed will prove better than the ordinary country breed.

Mr. Robertson's proposal to obtain a few Merino sheep from Australia is approved. The removal of the slaughter-house complained of by him has been directed (G.O., No. 122, dated 31st January 1882). Mr. Robertson's particular attention will be drawn to paragraph 10 of the Board's Proceedings of the 10th December last.

The School of Agriculture.—At the close of the two Sessions, twelve students are reported to have obtained first-class certificates and eleven second-class certificates. The Examiners speak favorably of the progress and conduct of the students.

The Government regret equally with Mr. Robertson that it was not possible to arrange for giving agricultural lectures in the Normal School. The matter, however, must not be lost sight of.

Physical training was carried out in a fairly effective manner.

The proposal for erecting a shed for meteorological purposes is approved and sanctioned.

The Government learn with satisfaction from a subsequent report of Mr. Robertson's, that most of the students who left the School after completing their studies have obtained useful and lucrative employments in different parts of the country.

The total cost of the whole Department, including the Saidápet Farm and the School of Agriculture, was Rs. 43,765-4-8.

(True Extract.)

(Signed) E. F. WEBSTER,
Secretary to Government.

To the Board of Revenue.
Educational Department.
Accountant-General.

Exd. W. H. French.

200 Copies.

Order, dated 28th June 1882, No. 650.

Government Farms and School of Agriculture
Reports on the — for 1880-81.—Reviewing—

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